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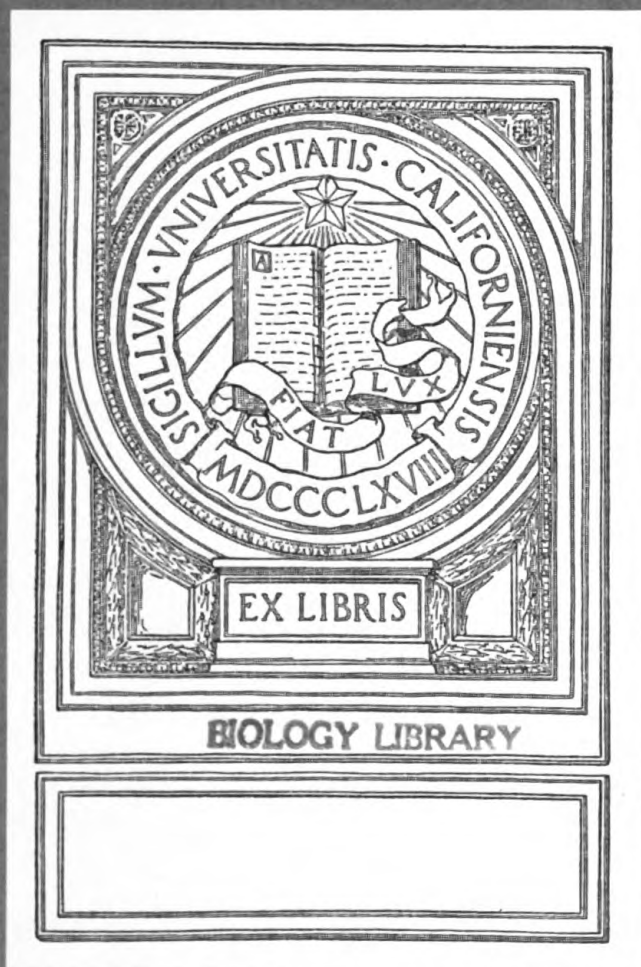


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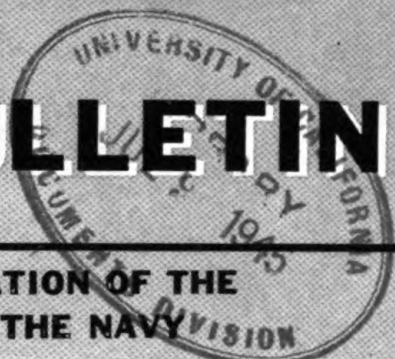
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UNITED STATES

NAVAL

MEDICAL

BULLETIN

v. 45
July-Dec. 1945

PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY

VOLUME 45

NUMBER 1-6



JULY 1945

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED 112



COVER PHOTOGRAPH

After Majuro was taken there remained other atolls in the Marshalls where Jap forces were located. On Wotje the Japs had a large contingent of native Marshallese laborers. The Civil Affairs Officer on Majuro, Lieutenant Bogan, sent a scouting party to Wotje to find out whether or not the natives wanted to desert; the report was that the natives were mistreated, were very short of food, and wanted to leave.

As dysentery was rampant among natives and Japs, it was necessary to segregate the incoming group. Commander A. C. Hohn (MC) USN, with 12 natives prepared a neighboring islet as a quarantine station. Seven hundred forty-two natives stole off Wotje by night in praus, being met by 2 LCIs which had been lying over the horizon. On arrival, every person was given a bar of soap and many children received their first soap bath. Foraging parties were sent out to gather coconuts and bread fruits. From among the people 10 leaders were selected and after instruction, were used as "sanitary engineers."

After a month no major illnesses remained. All personnel received three injections of neoarsphenamine, and were permitted to migrate to any adjacent island.

VOL. 45

JULY 1945

NO. 1

UNITED STATES
NAVAL
MEDICAL
BULLETIN



MONTHLY

DIVISION OF PUBLICATIONS
BUREAU OF MEDICINE AND SURGERY

Compiled and published under the authority of
Naval Appropriation Act for fiscal year 1945,
Public Law No. 347, approved June 22, 1944

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1945

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

All numbers up to and including 1921.

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Volume 17, 1922, Nos. 4 and 6.

Volume 18, 1923, Nos. 1, 2, 3 and 5.

Volume 19, 1923, Nos. 2 and 3.

Volume 20, 1924, Nos. 2, 5 and 6.

Volume 24, 1926, Nos. 1, 2 and 4.

Volume 25, 1927, Nos. 1 and 4.

Volume 26, 1928, Nos. 1, 3 and 4.

Volume 27, 1929, No. 4.

Volume 28, 1930, No. 1.

Volume 31, 1933, No. 3.

Volume 42, 1944, No. 2.

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Subscriptions should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

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All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

ROBERT C. RANDELL, *Editor,*
Commander, Medical Corps,
United States Naval Reserve, Retired.

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U. S. NAVAL MEDICAL BULLETIN

VOL. 45

JULY 1945

No. 1

SPECIAL ARTICLES

TAPE METHOD OF SKIN-GRAFTING

SAMUEL G. BERKOW

Lieutenant Commander (MC) U.S.N.R.

The purpose of this article is to describe a method of skin-grafting, the distinctive feature of which is the use of sterilized transparent adhesive tape. On this tape the graft is removed, transferred and secured to the recipient area. The severed skin adheres to the tape, retaining its normal tension, and does not contract or slip. Taped skin is manipulated with ease. Transparency of the tape is an aid in fitting the graft to its new site. Sutures are, as a rule, not required. Neither fingers nor instruments touch the graft. Painting of skin and instrument with rubber cement is eliminated. The method has proved to be simple, convenient, and rapid. Experience with 23 grafts in 16 patients has been favorable.

In the course of these operations, and of several animal experiments, many varieties of tape were tested. Several instruments were constructed, on the Padgett principle (1) but particularly adapted to the use of tape. Despite the diversity of tapes and instruments, successful grafts were obtained in each instance. This seems to indicate the fundamental soundness of the tape technic. The present armamentarium, which will be described, possesses certain advantages over previous instruments and tapes.

The tape method of skin-grafting may be particularly suited to military surgery. The simplicity of the technic recommends its trial in situations and conditions in which skin-grafting has hitherto not been practicable. Earlier grafting, especially of fresh wounds, would tend to hasten recovery, and prevent contractures and deformities. The tape method has not been tested on ship-

board or in forward zones, but the possibility of such early use seems to warrant investigation.

MATERIALS

Tape.—Ordinary adhesive tape was used in the first operation. The tape was flamed on both surfaces, and when sufficiently cool, the adhesive side was firmly pressed down on the donor area, which was prepared as later described. Despite the questionable sterility of this tape, a satisfactory take was obtained.

Special tapes were used in all of the succeeding cases. These tapes were submitted by two manufacturers.¹ The qualities investigated were: (1) Ability to withstand autoclaving for 15 minutes at 250° C. and 15 pounds' pressure without significant loss of the other requisite properties; (2) adhesiveness after autoclaving; (3) flexibility; (4) transparency; (5) brittleness (tear resistance); (6) elongation; and (7) irritation of the skin or allergic reactions.

Three elements in the tape were adjusted to meet requirements for improved tapes; namely, the adhesive, the base, and the binder.

All tapes which were examined were transparent. All withstood autoclaving without significant loss of body or adhesiveness. There has been no skin irritation or allergic manifestation.

Single and double-faced tapes have been tried. For the latter, a Holland-cloth interliner proved useful. Double-faced tape is advantageous, although not essential.

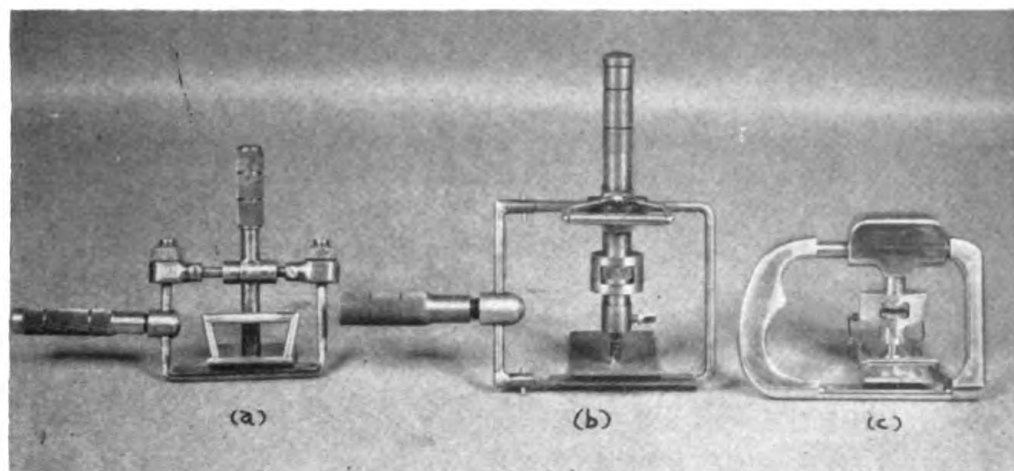
A tape consisting of a long rope fiber tissue combined with a cellulose acetate film base and a polyisobutylene adhesive, labeled "APV type," was used successfully.

A cellophane tape, coded ST 445, proved sufficiently adhesive, moderately flexible, but more brittle than desired. All cellophane tapes must be steamed after autoclaving to restore moisture. Paper proved, on the whole, more serviceable.

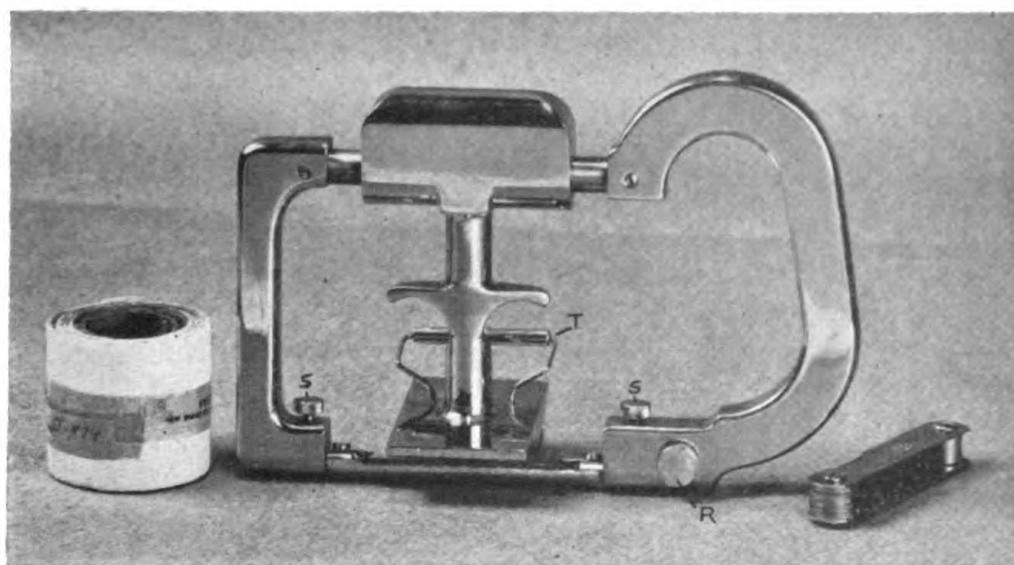
Cloth tapes have been developed which are superior for this purpose to all previous samples. At the request of the manufacturer, the nature of these film tapes cannot now be disclosed. Production of the most satisfactory tape may be limited, for the present, by critical shortages of material.

Dermasector.—Skin-cutting instruments were designed for use with 1½-inch tape, as it was found that this width is most readily manipulated. Several models were constructed, with the aid of Dr. A. M. Carr, of Metuchen, N. J., and of Lieutenant, junior

¹ Tapes supplied by Minnesota Mining and Manufacturing Company, Saint Paul, Minn., and Industrial Tape Corporation, New Brunswick, N. J.



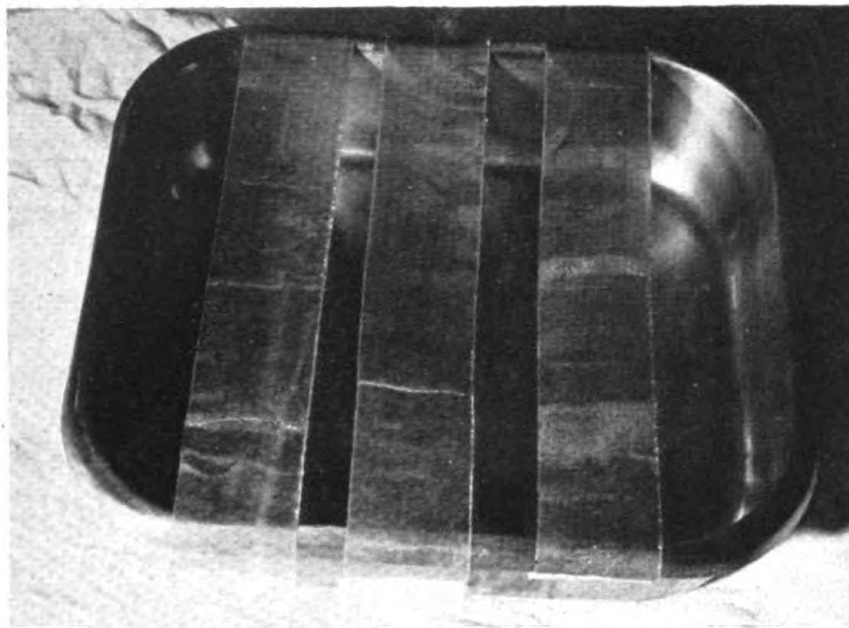
1. Dermasectors used in this series. (a) Model A. Depth regulated by raising cutting edge to swivel shoe by means of two adjusting screws, one on either side. (b) Model B. Depth regulated by lowering swivel shoe to cutting edge, using one central adjusting screw. (c) Model C. Modification of Model B.



2. Model D. This instrument permits more delicate depth control and possesses greater stability than previous models. Depth regulated by rotating cutting edge with reference to swivel shoe. Single adjusting screw (R). Before making this adjustment (for depth of graft), screws (S) are loosened. They are tightened after making the adjustment. Single tension bar (T). Feeler gage and tape (covered by Holland-cloth interlining) on either side of the instrument.

grade, W. Powell U.S.N., and Aviation Machinist's Mate, first class, D. H. Cowan, of the Naval Air Station, Norfolk, Virginia. The most satisfactory instrument (Model "D") is shown in figure 2.

In Model "A" the thickness of the graft is controlled by two adjusting screws, one on each blade arm (fig. 1a). In Model "B"



3. Tape fastened across small instrument tray for autoclaving.

(fig. 1b) the clearance between the cutting edge and the tape is controlled by an adjusting screw located in the swivel shaft. This arrangement permits a single, central regulation of the thickness of the graft. This is better than the bilateral adjustment in Model "A." Model "C" is a better designed instrument, similar to "B" (fig. 1c).

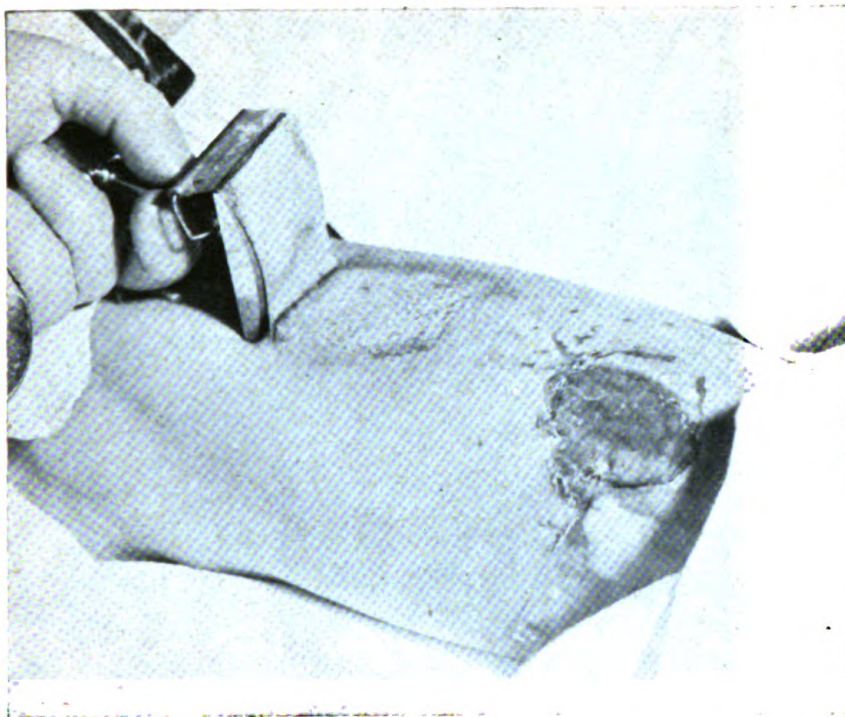
In Model "D" this adjustment is obtained through a device for rotating the blade. This controls the angle of the cutting edge with reference to the swivel shoe. The rest of the instrument is solidly fixed, providing maximum stability. It also seems to assure the most delicate regulation and finger-tip control of graft thickness. The instrument is small, compact, sturdy, and is easy to manipulate (fig. 2).

The cutting edge consists of a single safety razor blade. A roller and spring attached to the swivel keeps the forward end of the tape under tension. Clearance (hence graft thickness) is measured by means of a "feeler gage" which is readily obtained from automotive supply stores.

This instrument has been called a "dermasector" to distinguish it from the dermatome.

TECHNIC

1. Several strips of the tape are cut into approximately 10-inch lengths. These strips are placed across the top of a small instrument tray, only the ends of the tape being attached to the metal (fig. 3). For ease in handling, a small piece of Holland cloth, cut



4. Tape graft ready to be severed, for grafting of large wound caused by 50-mm. machine gun shells. Part of the area already grafted.

from the tape covering, is fastened tightly to one end of each tape.

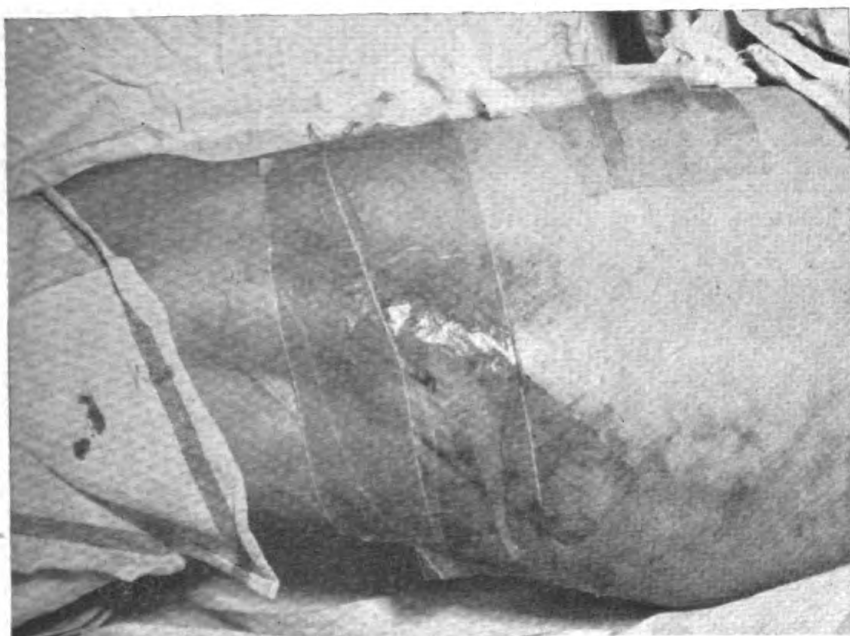
2. Donor and recipient areas are prepared as usual, then thoroughly washed with alcohol and rinsed with ether.

3. A small strip of autoclaved tape is placed on the desired thickness of feeler gage. The tape-covered gage is then introduced from the back of the blade, and between the swivel shoe and the cutting edge. The adjusting screw is turned until the razor edge touches the gage. The instrument is locked in this position and the gage is removed.

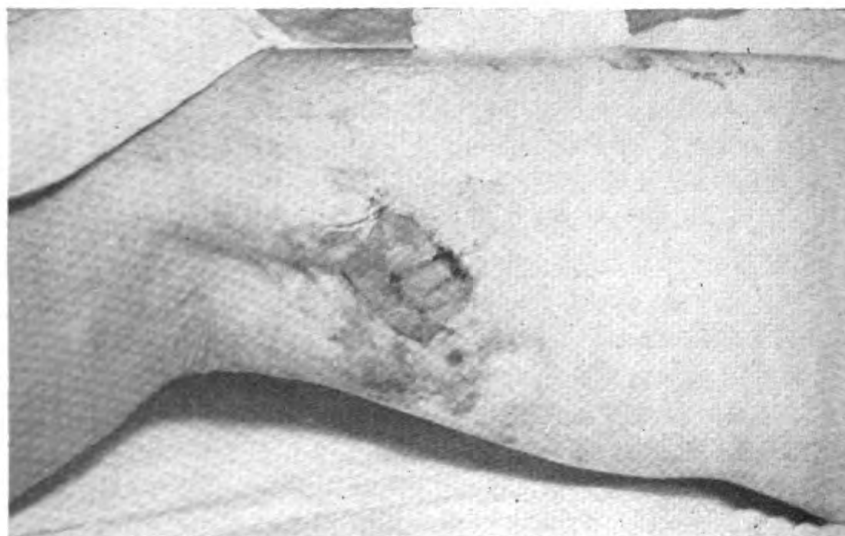
4. A length of autoclaved tape is smoothed down upon the donor skin, except for about 2 inches at the forward end (from which cutting will be started). When double-faced tape is used, part of the interliner (at the forward end) should be removed and the rest left on until the tape is pressed down and becomes smoothly adherent to the donor skin.

5. The instrument is placed on the tape over the donor area, making sure that the tape edges are even with the sides of the instrument. Then the free end of the tape is threaded over the forward roller and secured, with tension, to itself.

6. The graft is cut in the usual manner. The tape, with its adherent skin, is cut free from the roller and fitted to the recipient area. It is fastened to the adjacent skin by means of the extra length of tape on either side. Several strips of tape are fastened



5. Tape graft secured by additional tape at end of operation (excision of burn scar).



6. Same case on removal of tape, 6 days after operation (first dressing). The graft is violet in color. Tape marks are visible in this illustration.

crosswise over the first tape, to secure the graft firmly (fig. 5).

When a number of such grafts are used to cover the recipient area, each graft-bearing tape is trimmed to the graft margins. The taped grafts are then placed on the recipient area and secured to each other and to the surrounding skin surface by means of additional strips of autoclaved tape.

7. On smooth surfaces no further dressing may be necessary. Otherwise established routine as to dressings and splinting is followed.



7. Case 1. Avulsion, right ankle. Appearance 3 weeks after injury, before grafting.



8. Case 1. Eleven days after flamed ordinary adhesive tape graft.

The following case reports will illustrate the methods used and the results obtained.

CASE REPORTS

Case 1.—A seaman, second class, suffered an avulsion of the skin of the right ankle. The injury had occurred 3 weeks prior to admission, when his foot was caught between the fender and tire of an airplane tow-tractor. The



9. Case 3. Avulsion of the tips of the third, fourth, and fifth fingers caused by slipping of a steel cable. Preoperative appearance 2 weeks after injury.

avulsed area, over the lateral malleolus, measured 7 cm. by 4.5 centimeters. It presented a granular appearance, due to exuberant granulations on a bed of interlacing fibrous bands. The surrounding skin margin was thickened and slightly inflamed (fig. 7). Skin-grafting was performed on 2 September 1944. Flamed adhesive tape was used for removing, applying, and securing the graft. No sutures were used. Folded gauze squares and an elastic bandage were placed over the graft-bearing tape. Appearance of the graft on 13 September is shown in figure 8.

This case illustrates the successful use of flamed ordinary adhesive tape.

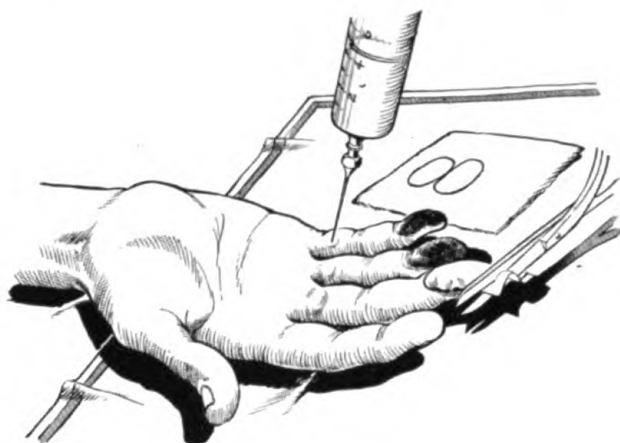
Case 2.—A seaman, second class, age 19 years, had a scar contracture of the left ankle. Three years prior to admission he fell from a motor-powered bicycle, suffering an avulsion of skin on the medial aspect of the left ankle. Healing by scar tissue was followed by repeated breaking down of this tissue. The latest episode occurred 17 days prior to admission, as a result of trivial injury.

The wound consisted of an egg-shaped granulating area, about 6 by 4 cm., over the internal malleolus. On 18 November 1944, the area was grafted with split-thickness skin on "APV type" tape. No sutures were used. On 10 February 1945, the graft was smooth, flexible, and could be moved over the underlying tissue.

This case is similar to case 1 except for the chronicity of the wound and the use of a special tape.

Case 3.—A chief boatswain's mate, age 34 years, was admitted with avulsion of the tips of the third, fourth, and fifth fingers of the right hand. The injury had occurred 2 weeks prior to admission when a steel cable had slipped through his fingers. There was almost complete loss of the finger pads of the three fingers involved (fig. 9). The wounds were crusted with seropurulent drainage. Wet dressings of calcium penicillin solution (500 units per cubic centimeter) were applied. Three days later the wounds were clean, and operation was performed. Patterns for the graft were made by applying sterile transparent tape to the wounds (fig. 10).

A single thick split-skin graft was removed from the abdominal wall under 1-percent procaine hydrochloride block anesthesia, on "APV type" tape (fig.



10. Case 3. Tape patterns being cut.

11. Case 3. Removal of donor skin, on tape.



12. Case 3. Tape-covered skin cut to pattern and secured to avulsed finger tips by additional tape strips.



13. Case 3. Appearance 3 weeks after tape-grafting.

11). Then the taped skin was cut to the patterns and each piece was secured without suture to the denuded finger tips (fig. 12). Appearance 3 weeks after skin-grafting is shown in figure 13.

This case illustrates the use of tape-and-machine grafts for very small areas in which the usual free graft and suture fixation is vexatious and seldom altogether satisfactory.

Case 4.—A lieutenant, junior grade, 23 years old, a fighter pilot, was injured in a combat zone on 10 October 1944, when a 20-mm. shell exploded in the cockpit of his plane. The right fourth and fifth fingers suffered traumatic amputation; there were shell fragment wounds, and a compound fracture of the distal end of the ulna. Debridement of this wound and application of sulfanilamide powder, vaseline gauze, dry dressing, and a cast, was followed by good bony union. A dense, adherent, V-shaped scar formed in this area, pulled on the adjacent skin and caused some pain and limitation of motion of the wrist. On 15 January 1945, he was admitted for this condition (fig. 14).

Operation was performed on 23 January 1945, using 1-percent procaine hydrochloride block anesthesia. The scar tissue was removed by sharp dissection, and the tongue of skin projecting into the scar tissue was undercut and sutured to the radial skin margin (fig. 15). This converted the V-shaped wound into a single oval wound, which was grafted with skin from the abdomen on ST 445 cellophane-base tape. No further sutures were used. The condition of the graft on 12 February is shown in figure 16. Successful grafting followed by physiotherapy (whirlpool baths) resulted after 3 weeks in a painless and pliant graft and unrestricted motion of the wrist.

This case illustrates the use of tape in combination with a suture technic. In retrospect, perhaps tape could have been used also to hold the undercut tongue of skin in its new position.



14. Case 4. Adherent scar, right forearm, 3½ months after injury by enemy action.



15. Skin flap shifted and sutured to radial skin margin. Remaining defect tape-grafted. The graft shown in the illustration did not cover the defect, so a second small tape graft was used.



16. Same case 20 days after operation. Both tape grafts, which can be seen in this photograph, took well.

COMMENT

The use of prepared, sterilizable tapes for skin-grafting in the manner described differs from the previous use of tapes in skin-grafting and seems to be superior to a somewhat similar technic previously published.

In 1943 Gabarro (2) described a tape method of skin-grafting in which the severed graft is placed on "stiff, sticky paper." He used "greasy and sterile paper supplied with boxes of 'tulle gras,' " or material of similar qualities, and cut skin and paper into strips "to obtain strips of paper with square grafts, well spread and evenly spaced."

There is greater resemblance between the present technic and that recently described by Roberts and Schaubel (3). In 42 of over 80 patients skin-grafted by their technic "the grafts were held on by means of flamed adhesive tape, occasionally with a few reinforcing sutures. On 30 patients the graft was held on entirely by means of silk sutures. The percentage of 'take' in both of the above groups was satisfactory."

At the same time Jenney (4) described the following technic:

A large piece of fine cotton bobbinet is thoroughly washed in soap and water, stretched with pins to its original dimensions and firmly pressed to flatten the threads . . . The drum of the Padgett dermatome is painted with rubber cement and allowed to dry for a few minutes. A piece of bobbinet is then rolled on the drum . . . Another coat of rubber cement is then applied. [The drum is autoclaved. If necessary, the sterilized drum is repainted.] The skin is then superficially incised with a scalpel along the line of the borders of the graft . . . The area within the incised line is cleansed with ether and painted with rubber cement; the area outside the incised line is powdered with talcum, sulfadiazine, etc., to prevent the rubber on the dermatome from sticking to the skin. The skin around the recipient area is painted with rubber cement. [The graft, cut in the usual manner, adheres to the rubberized bobbinet.] After cutting, the ends of the bobbinet are loosened and clamps are applied . . . By gentle traction the fabric with adherent skin is pulled off the drum. Graft and recipient areas are treated according to the plasma fixation technic of Sano.

This technic had been described previously by Sheehan (5).

Prepared, transparent adhesive tapes would seem to be more convenient, and perhaps more practical, than the bobbinet technic. The tape method is a simple and rapid means for severing, transferring, fitting, and securing skin grafts.

New dermasectors, designed for tape-grafting, are small and easily manipulated. The latest model, in which graft thickness is determined by rotating the blade, possesses several important advantages. Finger-tip control increases the accuracy of this adjustment. A single, replaceable razor blade is used. The stability of the apparatus is notable.

Although the tape technic is particularly suited to machine grafts, tapes may also facilitate free, or manual, grafting. In some circumstances, sterile adhesive tapes may serve to approximate incised wounds or to tack down a flap-avulsion.

Plasma-thrombin fixation of the grafts was considered, and may prove to be an important adjunct to the tape technic. In order to evaluate the results of tape-grafting per se, this fixation was not used in this series of cases.

Clinical experience with tape grafting has been favorable. The cases cited indicate its utility in several diverse conditions in which split-skin grafts were indicated. The tape method of skin-grafting is not offered as a finished technic. Improvements in tapes for this purpose are feasible, and are being investigated. Tapes for special types of skin grafts are a future possibility. The production of improved tapes should increase the efficiency of the technic and widen its scope.

Patch testing for skin sensitivity has not been performed with the present tapes. It should be done on each variety of tape offered for clinical use.

The immediate importance of the tape technic of skin-grafting is the possibility of utilizing it in combat areas and on shipboard.

In working out the materials and technic here described valuable assistance was received from many sources. Captain C. J. Robertson (MC) U.S.N., provided opportunity and stimulus. The A. & R. Department, Naval Air Station, Norfolk, Virginia, under Captain A. R. Sanborn U.S.N., cooperated in designing the latest dermasector models. E. S. Sies, toolmaker, not only made the instruments, but added several practical features. My colleagues on the Surgical Service, Naval Air Station Dispensary, Norfolk, suggested improvements in armamentarium and technic. Dr. H. M. Sonnichsen, of Industrial Tape Corporation, and Dr. J. E. Corbin, of Minnesota Mining and Manufacturing Company, produced the tapes on which the technic depends. To Dr. A. M. Carr, I am indebted for active collaboration in every phase of this investigation.

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POSTTRAUMATIC HEMOTHORAX MANAGEMENT

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The primary causes of early mortality from penetrating injuries of the chest are disturbances of cardiorespiratory physiology, and hemorrhage. Later death from thoracic wounds is the result usually of these two factors plus our continual enemy, infection.

Cardiorespiratory disturbances and hemorrhage, if not too severe and sudden, will respond to appropriate therapy. As is well known, shock and hemorrhage are of as prime importance in chest injuries as in any other injury and require immediate attention. The management of shock has been well described elsewhere, so this discussion will be concerned with the more specialized handling of thoracic hemorrhage.

Hemorrhage into the pleural cavity occurs in nearly all penetrating wounds of the thorax. Any one or a combination of the following thoracic vessels may be involved: The intercostals, the internal mammary, the large intrathoracic hilar vessels, or the vessels of the lung parenchyma.

The diagnosis of hemothorax is made when there is:

1. A bullet wound or other perforation of the chest wall (wounds with portal entry elsewhere can and do reach the chest).
2. Dullness on percussion.
3. Shift of tracheal and mediastinal structures from hemothorax.
4. Absent breath sounds.
5. Impaired excursion of the chest wall.
6. Positive x-ray findings.
7. Diagnostic aspiration.

Small bloody effusions in the pleural cavity are absorbed spontaneously but the larger ones are best handled by slow aspiration or gradual gravity drainage. The bloody fluid is not replaced by air. In the presence of a massive organized hemothorax, radical management by thoracotomy is the procedure to be followed. Manual evacuation of the clot and decortication of the lung have proved its effectiveness in returning patients to duty early and

THORACIC CIRCULATORY SYSTEM

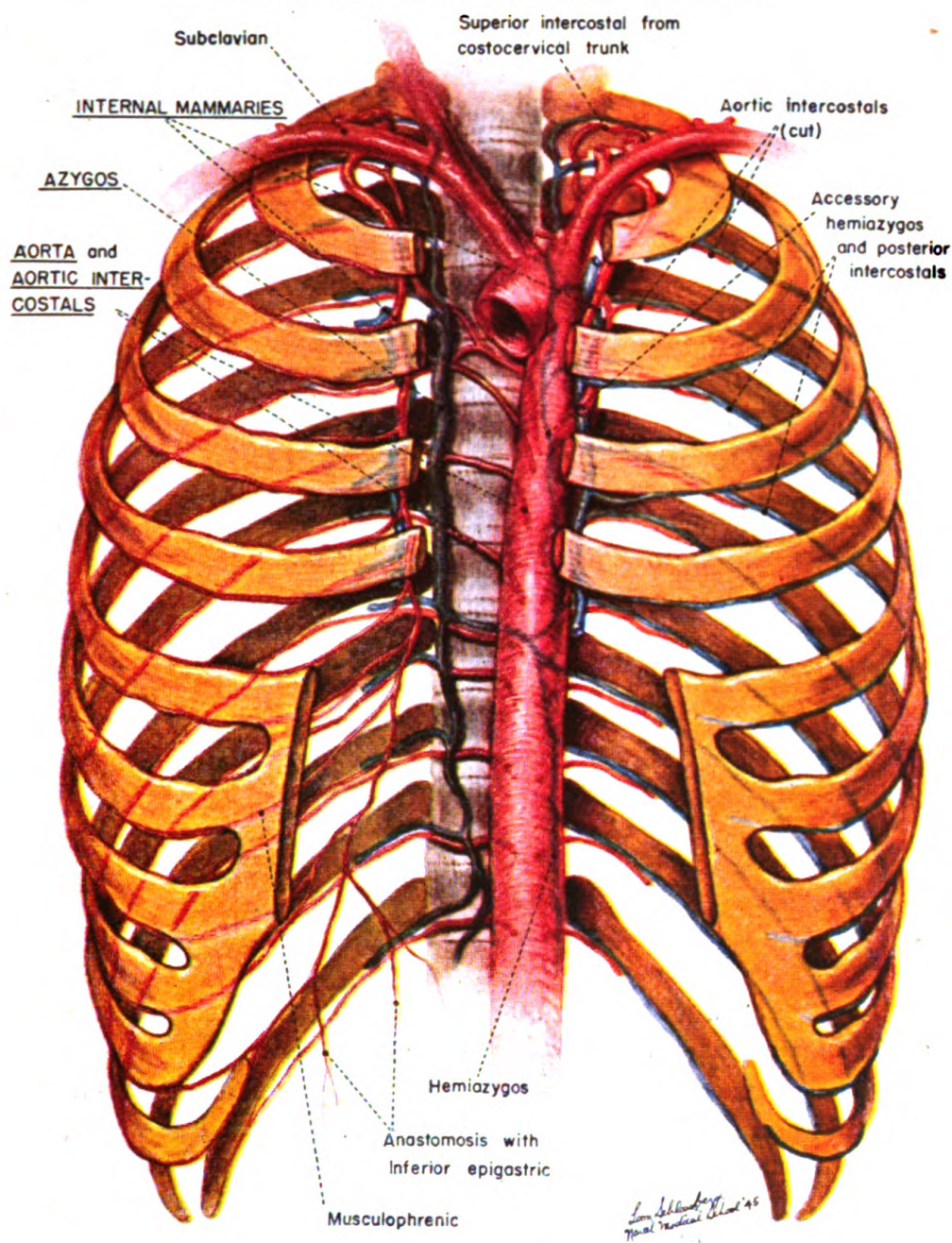


Figure 1.

appears to have diminished the incidence of empyema markedly.

In hemothorax of traumatic origin, aspiration is preferred to conservative "let alone" treatment because:

1. Morbidity is reduced. The majority of patients with uncomplicated cases from through-and-through chest wounds are thereby

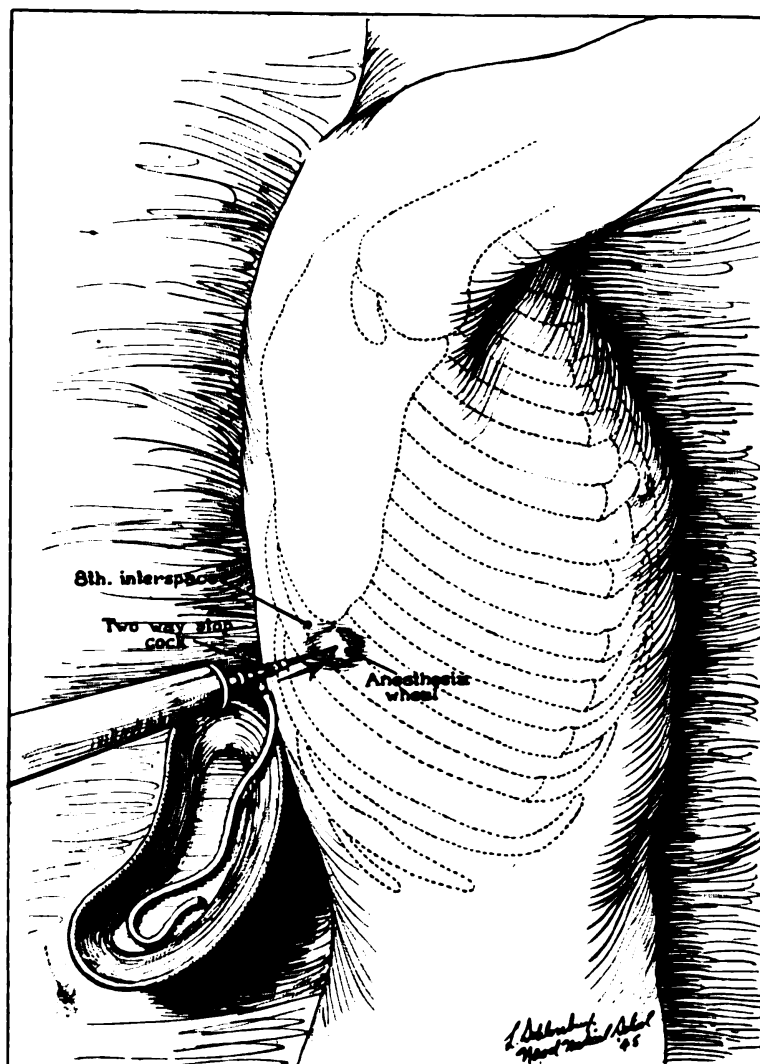


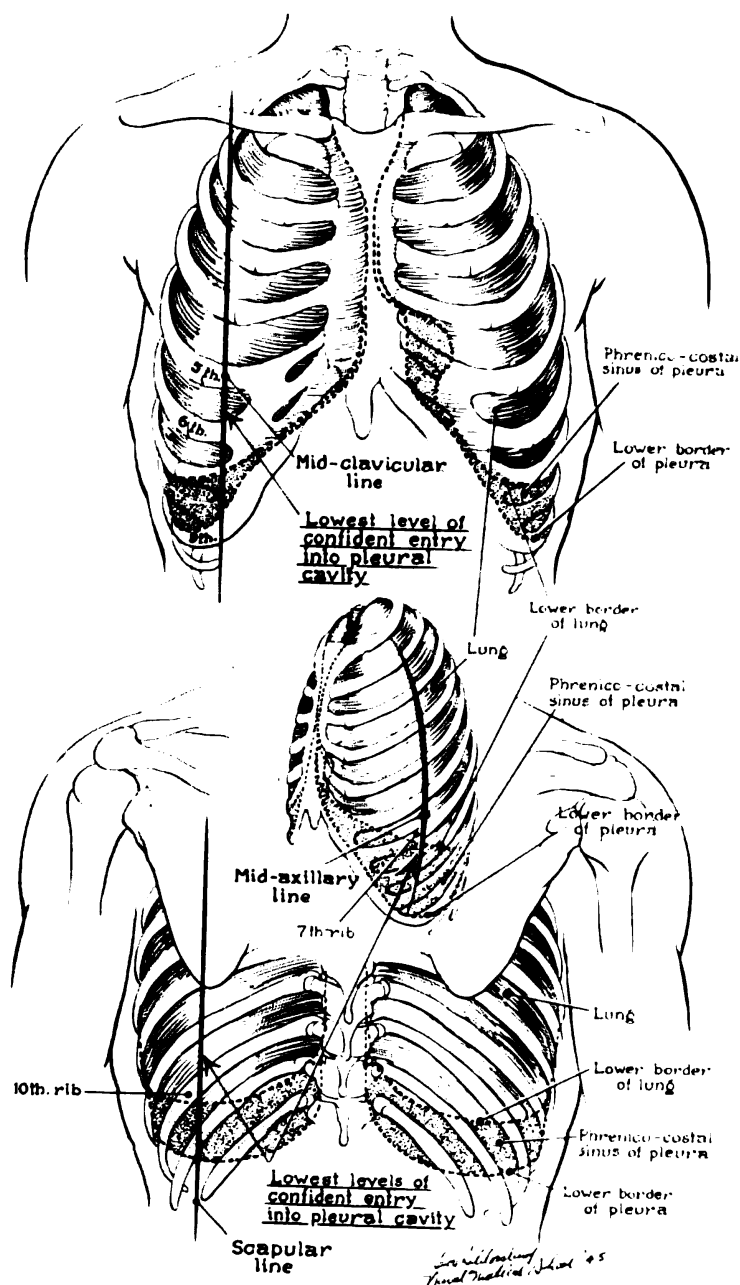
Figure 2.

returned to full duty within 60 days in most instances and evacuation to rear areas can be avoided.

2. Complications which occur in an appreciable percentage of these cases can be avoided entirely or made much less of a problem. The object is to reduce the size of the hemothorax and to get the lung re-expanded as rapidly as possible. In those cases in which aspiration has not been done, chronic fibrothorax has been found to occur with significant frequency. Experience has shown that the latter condition greatly prolongs the morbidity and usually requires radical thoracotomy for evacuation of the fibrin clots. The incidence of secondary empyema is reduced, but when it occurs, previous aspirations have reduced the volume of the involved pleural cavity and the resulting empyema is consequently smaller.

Patients who have hemothorax with associated major chest-

Figure 3.



wall or lung damage or both should be evacuated to the rear whenever their condition permits transportation.

In performing aspiration, it should be borne in mind that the lowest levels at which the needle may be inserted in entering the pleural cavity are (1) the posterior axillary line at the ninth interspace; (2) the midaxillary line at the seventh interspace; and (3) the anterior axillary line at the fifth interspace (fig. 2).

Aspiration may be necessary at several levels (fig. 3). This is particularly true if clotting of blood or formation of fibrin bodies

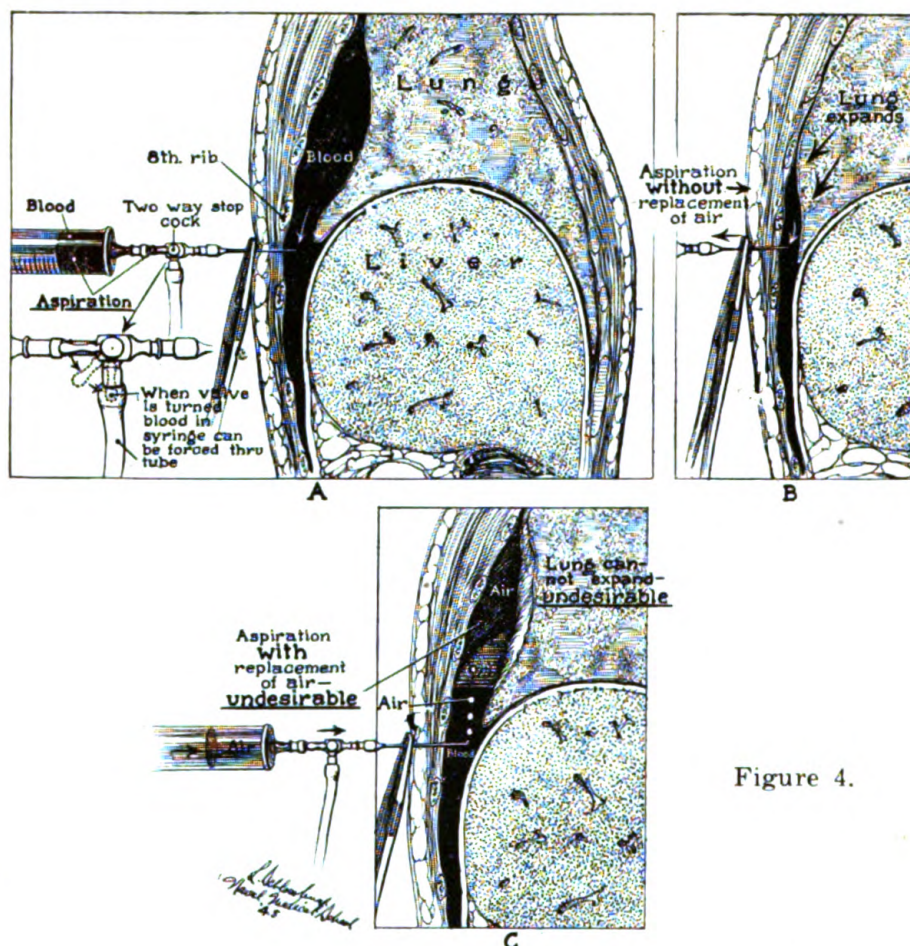


Figure 4.

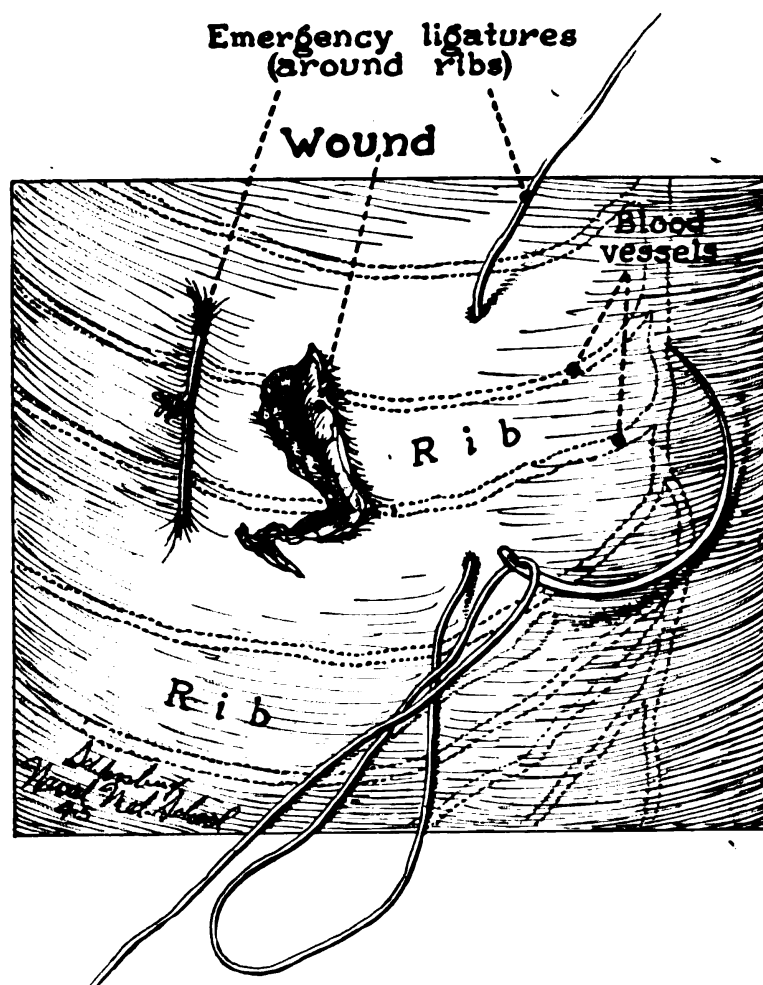
has begun. Under such circumstances it may be necessary to aspirate rather high to reach the fluid contents.

Air replacement is to be avoided (fig. 4). The theory of air replacement is that secondary bleeding is less likely to occur and that more fluid may be aspirated with less discomfort. Secondary hemorrhage following aspiration is extremely rare. In most hemothorax cases immediate aspiration is not necessary. It may be delayed a day or two until bleeding has ceased. Urgency is indicated only when the bleeding has occurred in sufficient volume to threaten suffocation of the patient. Air replacement defeats the objective of rapid re-expansion of the lung and obliteration of the pleural cavity, and it prolongs morbidity to no useful purpose.

In general, aspiration may be continued until the patient complains of pain or discomfort in the chest. This is the most reliable criterion of when to stop aspiration.

Injuries to the intercostal vessels give the typical signs of internal hemorrhage and pleural effusion, such as increasing pallor, restlessness and thirst, increasing rate and decreasing volume of pulse, falling blood pressure, increasing respiratory rate, and

Figure 5.



cyanosis replacing initial pallor. In uncontrolled hemorrhage of the intercostal artery, ligation should always be done on *both sides* of the bleeding point before dividing the vessel (fig. 5). The vessel can be exposed by resection of the involved rib, usually at the site of the wound. As an emergency measure hemorrhage from an intercostal vessel may be controlled by passing a pericostal suture on both sides of the bleeding area.

Injury to the internal mammary artery is always urgent and requires immediate attention.

The internal mammary artery may be ligated through a transverse incision at the level of the second or third intercostal space (fig. 6). However at a lower level it is generally necessary to resect a portion of one of the costal cartilages.

Hemorrhage caused by laceration of the large hilar vessels is rarely amenable to treatment, as death occurs rather rapidly from exsanguination.

Lacerations of the lung parenchyma are seldom profuse and may even be self-controlling. Hemoptysis is usual in these in-

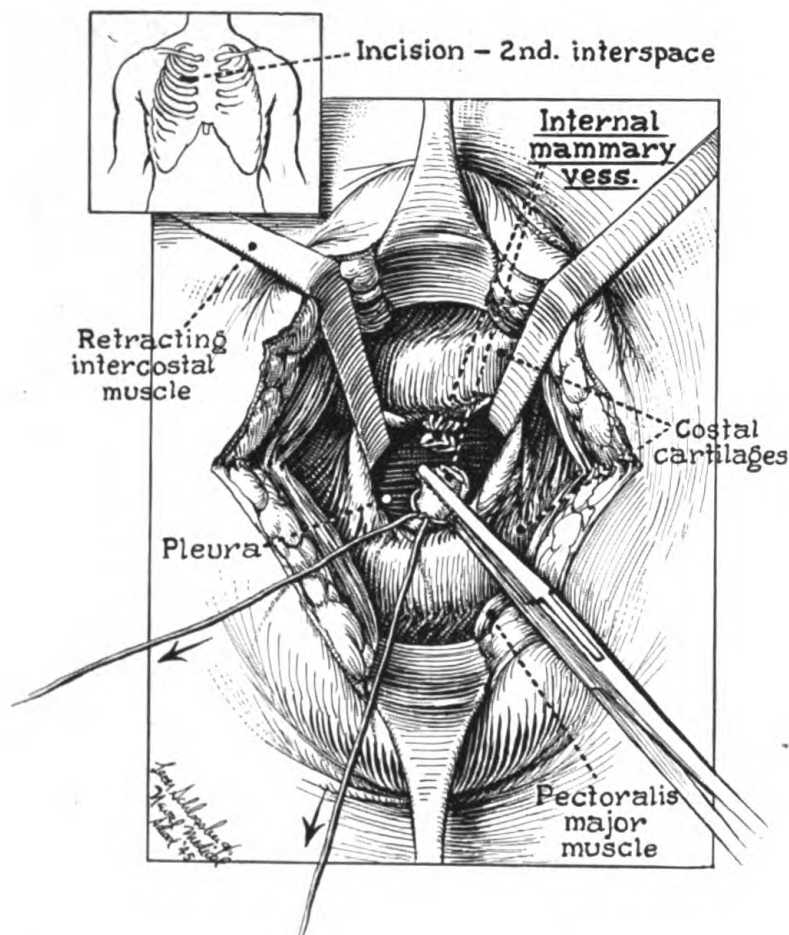


Figure 6.

stances as contrasted to its rare appearance in the preceding conditions. In the event that bleeding from peripheral lacerations does not stop spontaneously, or if the hemorrhage is persistent or massive, an open thoracotomy is indicated.

The incidence of pleural infection resulting from combat wounds is directly related to the type of early care these patients have received. Precise surgical management, together with the judicious use of the sulfonamides and adequate penicillin, has greatly reduced the number of empyemas.

SUMMARY

1. Hemorrhage into the pleural cavity occurs in nearly all penetrating wounds of the thorax.
2. Small bloody effusions absorb spontaneously; larger ones require aspiration.
3. Aspirated fluid should not be replaced by air.
4. In the presence of massive organized hemothorax, radical management by thoracotomy is the best procedure.
5. In uncontrolled hemorrhage of the intercostal arteries, liga-

tion should always be done on both sides of the bleeding point.

6. Injury to the internal mammary artery is always urgent and requires immediate attention.

7. Hemorrhage from lacerations of the large hilar vessels is rarely amenable to treatment.

8. Lacerations of the lung parenchyma are seldom profuse and may be self-controlling. If hemorrhage is persistent or injury is massive, radical thoracotomy is indicated.

9. In particular a plea is made for aspiration in the treatment of traumatic hemothorax. The morbidity is thereby reduced and many men may be returned to duty without evacuation to distant rear areas. Furthermore complications such as chronic fibrothorax and secondary infection of the pleural space are greatly reduced.



MOSQUITO SOUNDS RECORDED

The destruction of disease-carrying mosquitoes is a problem of the first magnitude. It was thought that mosquitoes might have characteristic "mating calls." A microphone, amplifier, band pass filters, and disk recorder were used and characteristic mosquito sounds were recorded which are faintly audible or completely inaudible to the human ear. These sounds are now able to be transmitted with the end in view of calling specific varieties of mosquitoes to a place of destruction.

Despite the great variety of sounds, each genus and species has tonal emanations which are so distinctive in character that an experienced observer can not only readily distinguish one genus from another, but with no difficulty at all can also distinguish the male of a species from the female of the same species.

The sounds appear like bird calls. The fundamental tones recorded to date lie in the range from 250 cycles per second to 1,500 cycles per second. All "male voices" so far recorded are higher pitched than the females.

Pitch is a simple means of distinguishing one mosquito sex from another. Female voices contain far more energy than males even when the insects are not in flight.

It was shown that the noise of the single female will cause the males of the same species to burst into an answering chorus, and under a microscope it was seen that the antennae and hypopygium of the male turns in the direction from which the sound is transmitted.

As far as we can determine at the present time, the sounds seem to be produced by three methods: (1) Noises made when the mosquitoes are in flight; (2) the beating of the wings while the insects are at rest; and (3) the rubbing of the tarsi against the wing.—KAHN, M. C.; CELESTIN, W.; and OFFENHAUSER, W.: Recording of sounds produced by certain disease-carrying mosquitoes. *Science* 101: 335-336, March 30, 1945.

PLASTIC TECHNIC IN SURGERY OF PERIPHERAL NERVES

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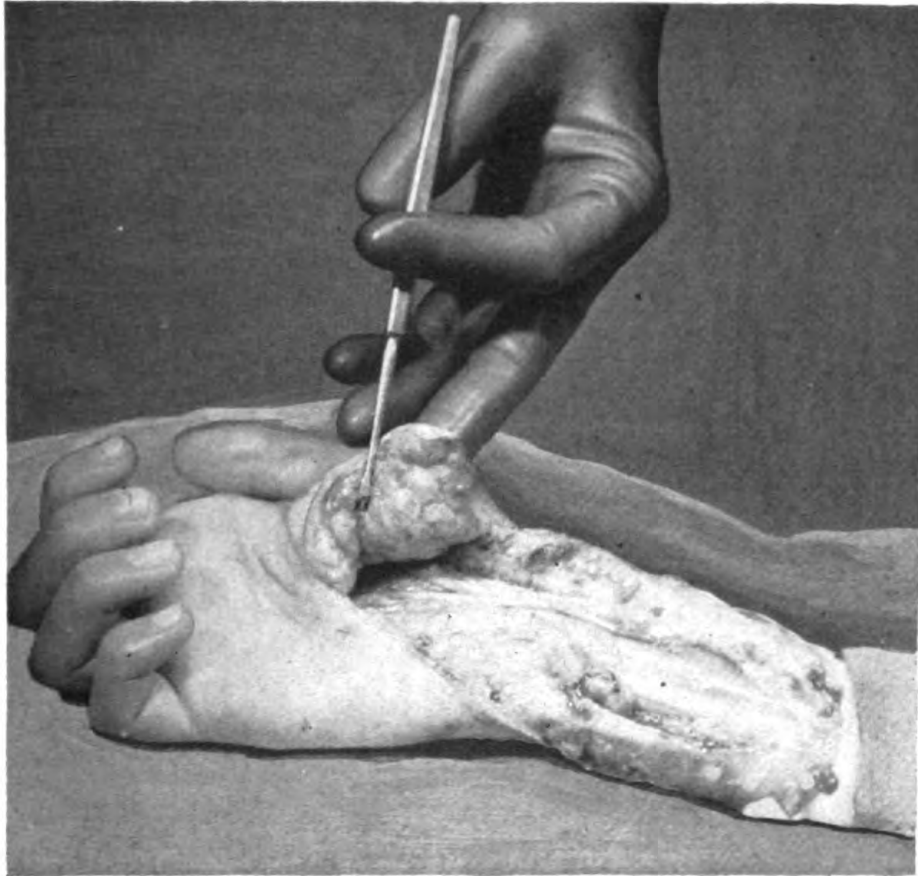
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A close association of the specialties of plastic surgery and neurosurgery at this hospital has resulted in the application of certain technical details from the field of plastic surgery to the surgery of peripheral nerves. These details have been of value in improving the technic of peripheral neurosurgery. Those which have been of most value are: (1) The use of the bloodless field for all surgery of the extremities; (2) the "S" incision; and (3) plastic wound-closure, dressings and after-care.

Use of the bloodless field.—Visibility during dissection is greatly aided by the use of a tourniquet to produce a bloodless field. This point has been emphasized by Bunnell (1), Koch (5), Mason, and others; however its application in neurosurgery has been neglected. Tissues can live without blood supply for over an hour with apparently no appreciable ill effects. By releasing a tourniquet, and restoring the circulation for 10 minutes, an additional hour may be secured.

Before the extremity is prepared, a pneumatic tourniquet (blood pressure cuff) is bandaged about the upper arm or leg with ordinary roller-gauze bandage to prevent its slipping during operation. It is not inflated at this time. After the limb is prepared and draped, a sterile Esmarch bandage is wound spirally about the limb, from finger tips or toes proximally, overlapping about $\frac{1}{2}$ inch at each turn. This is wound to within 2 inches of the level of the blood pressure cuff, which lies beneath the drapes. The cuff is inflated to well above the level of the systolic blood pressure and the tubing clamped with rubber-shod clamps to maintain the pressure, after which the Esmarch bandage is removed and the operative procedure begun. Visibility of all structures is clear and unobstructed by blood (fig. 1).

Immediately upon completion of the dissection, the tourniquet is released, moist gauze sponges are placed in the wound and firm

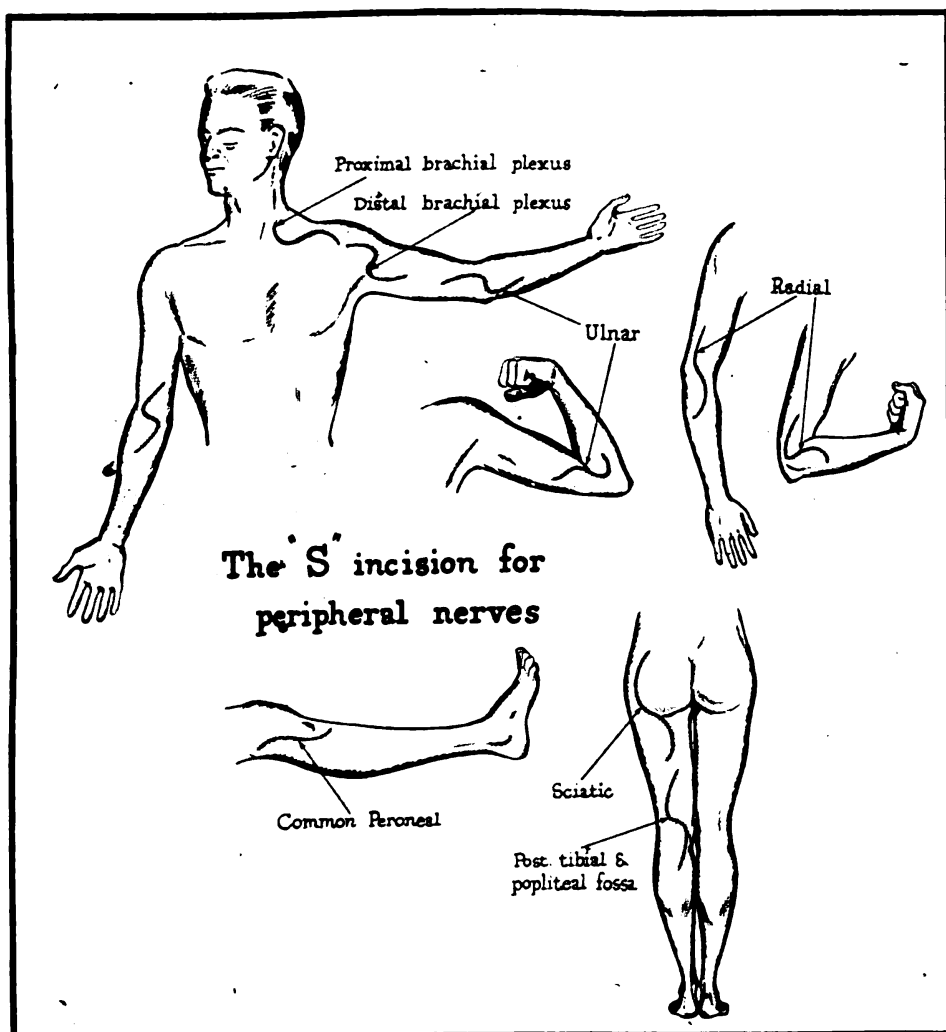


1. View of a right hand exposed at operation showing two small sural nerve grafts in place to cover a defect of the median nerve. In addition to the "S" incision, a pedicle flap of skin and fat has been placed on the palm to relieve scar and provide a suitable bed for the nerve grafts. Excellent visibility of all structures in a bloodless field is illustrated.

pressure is applied. After about 5 minutes, removal of the gauze may reveal a few bleeding points which must be clamped and tied. The tissues are kept moist during the bloodless dissection by normal saline solution.

The "S" incision.—Perhaps the most important point of collaboration between the specialties of plastic and neurosurgery is the planning of the proper incisions for the exposure of peripheral nerves. Surgical incisions produce scar contractures when their long axes cross the cutaneous flexion creases at a right angle. Consistent disregard of this proved fact has led to useless disfigurement and disability in many patients.

Crossing flexion-creases at right angles can be avoided, as pointed out by several authors. Most prominent of these has been Bunnell whose criticism of the "pernicious median-longitudinal incisions" in the hand has been amply supported. His curving

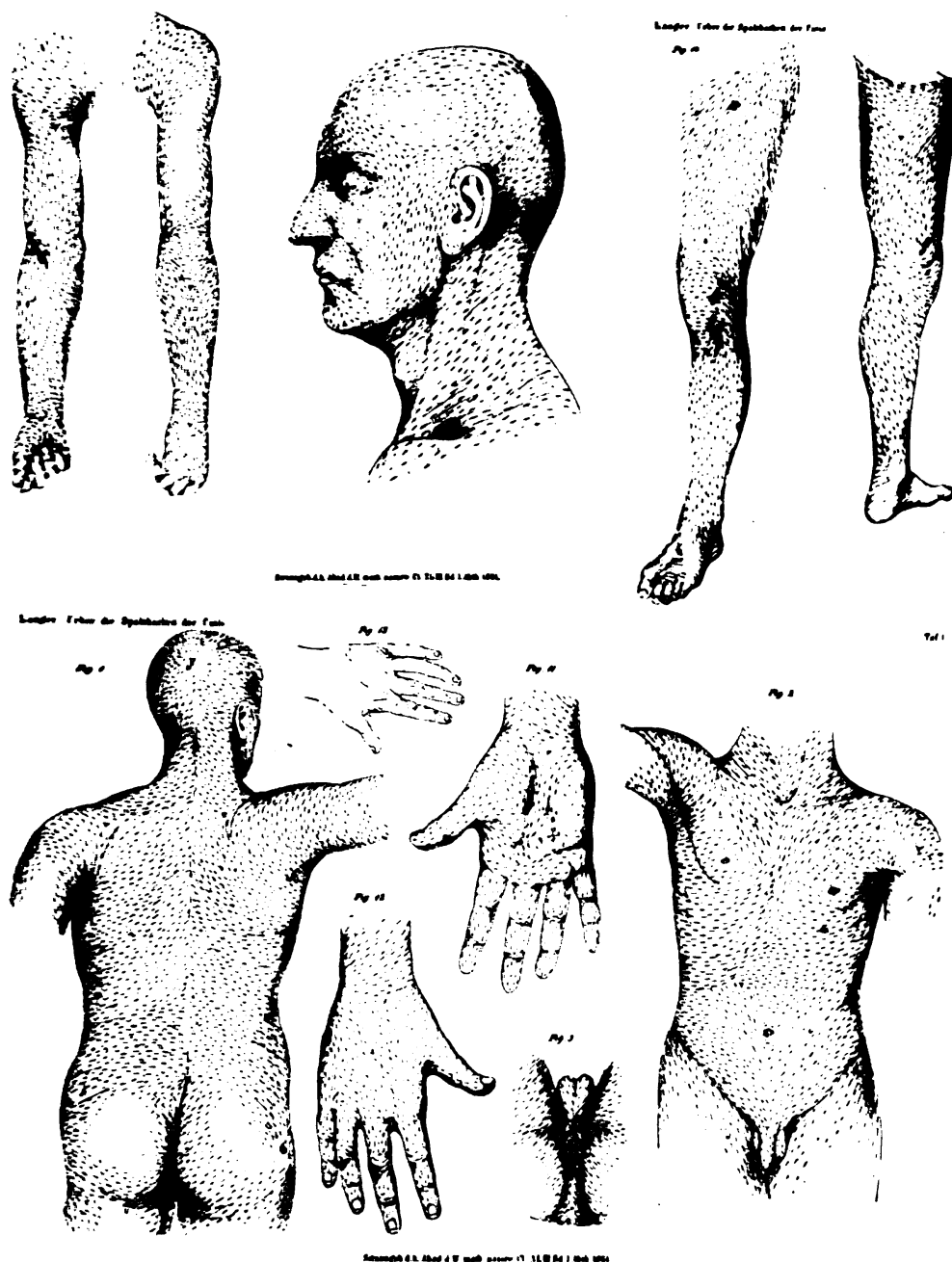


2. Examples of the "S" incision commonly employed in peripheral nerve surgery. Incisions conform to flexion creases, thus allowing maximum exposure without subsequent impairment of joint function.

and lateral incisions carefully avoid crossing a flexion crease at right angles and adaptations of his teachings have been used to give the "S" incision, here described, for surgery of peripheral nerves (fig. 2).

The original lines of Langer (6) (fig. 3) have served as patterns for the "S" incision. Davis (2) and J. P. Webster (8) have emphasized their importance, and Holman (3) has recently described proper direction of skin incisions in the neck.

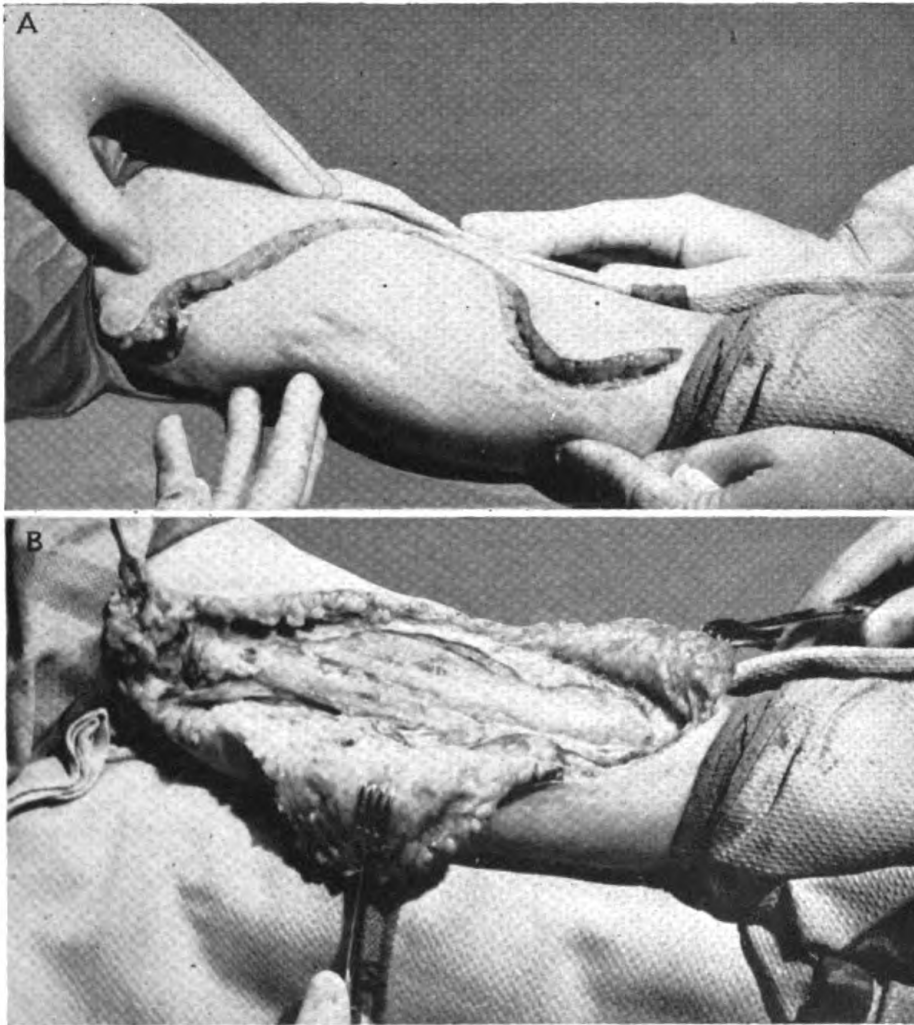
Neurolysis, nerve suture or nerve grafting require full visualization of an adequate length of nerve. Wide exposure is provided by the "S" incision (fig. 4). A linear incision not only produces a scar contracture in its long axis but gives an elliptical operative field. The "S" incision outlines two opposing flaps of skin and



3. The original diagrams of Langer showing directions of normal skin lines about the body. These lines have served as the basis for the "S" incision.

subcutaneous fat, the blood supply of each of which is adequately furnished by a broad base. Closure of the wound is as simple as that of a linear incision and scar contractures do not occur. Flexion of the scar simply "folds" the incision, avoiding the stresses on the scar which produce contractures (figs. 5 and 6).

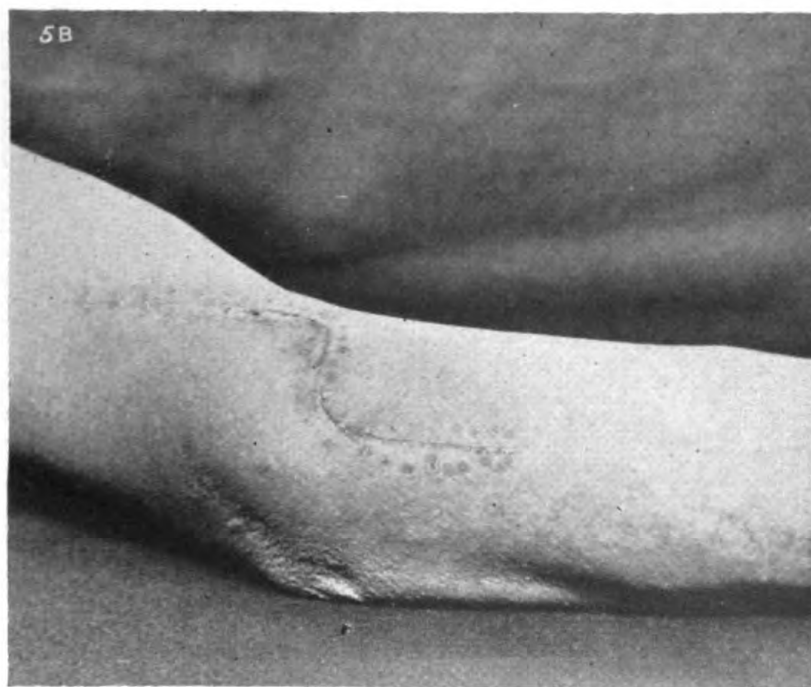
In the dissection of the flaps of skin and subcutaneous tissue, one must be careful to avoid cutting too close to the skin. If the incision is extended for any reason, it must not narrow the base



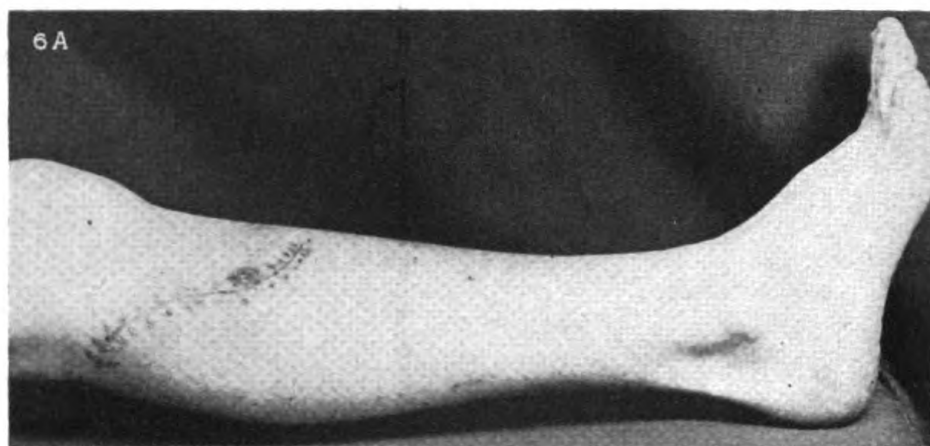
4. "S" incision on the posterior aspect of the lower leg, extended laterally in its uppermost portion to expose the peroneal nerve. (A) Tissues in position following incision. (B) Flaps dissected and retracted to show the extremely wide area of visibility made possible by the use of the principle of the "S" incision.

of one of the flaps. The blood supply of a flap could be irreparably damaged by such an error. If extended length of incision is needed, an additional S-shaped curve can be added to either end of the existing "S" to form three or even four similar flaps (fig. 4). Flaps should not be flexed too acutely at their base during retraction because small vessels may be damaged, and poor circulation exists in the flap during the entire time its base is kinked.

Color of the flaps should be noted at all times and if a blanched or cyanotic edge appears, it should be observed for a few minutes in order to determine the possibility of circulation returning. If circulation is impaired, the avascular tissue must be debrided to prevent necrosis and delayed healing. Elasticity of the flaps will



5. An "S" incision at the elbow showing normal conformation with flexion creases. (A) Arm flexed. (B) Arm extended, viewed from ulnar side.



6. Recently healed "S" incision employed to expose a peroneal nerve. Photographs were taken early while the scars were still red to make the incisions more clear photographically. (A) Leg extended. (B) Leg flexed.

allow closure notwithstanding considerable change in contour.

The "S" incision has been plotted specifically for exposure of common peripheral nerve lesions.

CASE REPORTS

Case 1.—A 27-year-old seaman, second class, suffered from partial severance of the ulnar nerve at the elbow by a penetrating glass fragment 3 years prior to admission. Examination showed hyperesthesia of the left fourth and fifth fingers of the metacarpophalangeal joint, atrophy of the interosseal and hypothenar muscles, partial atrophy of the thenar eminence and a typical ulnar distribution of anesthesia in the hand.

At operation, the ulnar nerve was exposed at the elbow using an "S" incision. A lateral neuroma was resected and the nerve transplanted anteriorly beneath the attachment of flexor muscles of the forearm. The wound healed without complication.

Case 2.—Fourteen months prior to admission a 31-year-old electrician's mate, first class, sustained a laceration of the right wrist by plate glass which severed the flexor tendons and median nerve. Both the nerve and tendons were sutured shortly after the accident. At the time of admission to this hospital, the patient complained of inability to close the hand and of anesthesia of median nerve distribution.

An "S" incision extending across the flexion crease of the wrist was used for exploration. Since the nerve was in good continuity, an endoneurolysis was performed. Tendons were also freed from the scar. The wound healed per primam and the patient was discharged to limited duty for a period of 3 months.

Case 3.—Three months prior to admission a fireman, first class, was struck in the lateral aspect of the right leg by two shell fragments. The wounds healed per primam and examination on admission to this hospital showed two healed wounds, one 5 inches and the other 7 inches below the knee. Neurologic examination showed slight weakness of the dorsiflexion of the right foot and third, fourth and fifth toes. There was loss of sensation over the lateral aspect of calf and foot.

The common peroneal nerve was explored through an "S" incision. A large neuroma of the superficial peroneal nerve was found. Since the lesion was incomplete and continuity of the nerve was preserved, a neurolysis was performed. Healing of the wound was uneventful.

Plastic wound closure, dressings, and aftercare.—Hemostasis in peripheral neurosurgery should be meticulous and avoid unnecessary tissue destruction. Small pointed mosquito hemostats are favored. Much bleeding can be controlled by pressure alone, using moist saline sponges. Plasma clot, fibrin foam, and fibrinogen-thrombin mixtures have not been utilized long enough to test their effectiveness thoroughly but when used they have shown value, especially in controlling bleeding from a nerve stump after a neuroma has been resected. The finest diameter of suture material which is consistent with security is used.

Problems of wound closure are greatly simplified by resourcefulness in applying skin-grafting methods. This is particularly true in the severely scarred or poorly vascularized areas which commonly follow war injuries. Split-thickness, or rarely full-thickness grafts are readily available either by freehand technic

or by the use of the dermatome. Pedunculated flaps of skin and fat can be raised and transferred in many ways (7) in order to facilitate repair.

Plastic closure of peripheral wounds is well worth the slight extra time and care expended. By this is meant the use of fine buried suture material in the subcutaneous tissues to relieve stress on the skin closures, and accurate "tailoring" and fitting of the skin edges to secure the most accurate edge-to-edge approximation possible. No sutures are pulled taut to constrict the healing skin edges, and early removal of skin sutures is advisable.

Splints are used to put the part at rest or to maintain relaxation of a newly sutured nerve or tendon. They should be well planned to secure best possible position for all joints involved, and particularly in the hand should maintain the position of function wherever possible. This position is a "cock-up" for the wrist and an apposition of the thumb and fingers. Plaster of paris is easily malleable for most purposes, but metal splints have the advantage of being removable and are more useful during prolonged convalescent periods. They can also be boiled and applied at operation while the wound is still open.

Pressure dressings are emphasized in plastic surgery and can be used with advantage by the neurosurgeon in peripheral nerve surgery. Their advantage lies in maintenance of adequate circulatory balance, avoiding venous and lymphatic stasis. They are built up about the wound with fluffed, resilient gauze bound firmly in place with an ordinary nonelastic gauze bandage and secured with adhesive tape. Constriction is avoided if the pressure dressing is sufficiently large to distribute pressure evenly. Toes and finger tips should be left exposed wherever possible to observe circulation after operation.

The balance between arterial supply and venous return in the peripheral capillary bed of an extremity contributes greatly to the quality of wound repair. Arterial supply is usually adequate but venous and lymphatic flow may be impeded by a variety of factors, among which are local tissue reaction to the trauma of operation, and particularly the force of gravity. Normal venous pressure runs from 7 to 10 cm. of water, and if a limb is allowed to rest at or below the level of the auricles of the heart, this gradient has a tendency to favor chronic passive congestion. As a consequence cellular metabolism is affected, resulting in decrease in oxygen tension and retention of metabolites; cellular efficiency is decreased, and in extreme cases death of the individual cell and wet gangrene of the part take place, the latter particularly when venous stasis is severe.

A favorable gradient in the venous and lymphatic systems can be secured in the extremities by elevation. If an arm or leg is elevated on pillows or platform splints, and the patient remains recumbent, venous and lymphatic circulation returns and wound healing is favored.

Once wound healing has been secured, resumption of normal dependent position for the extremity is begun gradually, allowing the limb to become dependent for a few minutes and then returning to the elevated position, repeating this process at intervals until normal circulatory balance has been re-established. In the case of lower extremities, supportive bandages are worn for a short time after the patient is allowed out of bed.

Color of the dependent extremity is the best index of circulation; purplish, blotchy discoloration is a sign of imperfect venous return, indicating the need for return of the part to the elevated position and a more gradual resumption of dependency.

SUMMARY

Plastic surgical technic is of value in the surgery of peripheral nerves. This may involve alterations of soft tissues at the time of initial injury or be concerned with late repair. Three specific points of technic are discussed, which are of particular value: (1) Use of the bloodless field for all surgery of extremities; (2) the "S" incision; and (3) plastic wound closure, dressings, and aftercare.

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CUTANEOUS ANESTHESIA WITH ICE

Cutaneous pyogenic infections in the form of boils, abscesses and infected sebaceous cysts are encountered with great frequency during prolonged operations aboard ship in tropical and semitropical areas. An appreciable number of these lesions eventually require surgical drainage. Local anesthesia with procaine hydrochloride is unsatisfactory or contraindicated and pentothal sodium intravenously is usually impractical for a surgical procedure of such minor nature. Although local ethyl chloride spray is probably the method of choice, this agent is not available in the Supply Catalog of the Medical Department because of its inflammability.

During a period of 2 months, ice has been employed as the only anesthetic agent for the incision and drainage of a series of 45 superficial infections observed aboard ship.

Effectiveness of cutaneous ice anesthesia in superficial infections

Location of lesions	Number and type of lesions			Effectiveness of anesthetic		
	Boils	Abscesses	Inf. cysts	Poor	Good	Excellent
Face.....	6	3	1	1	6	3
Neck.....	1	1	3	0	4	1
Trunk.....	5	3	0	0	7	1
Buttocks.....	2	3	0	1	2	2
Scrotum.....	0	0	1	0	1	0
Arms—forearms.....	3	1	0	1	3	0
Fingers.....	1	3	0	0	4	0
Thighs—legs.....	3	3	0	1	4	1
Feet.....	0	2	0	0	0	2
Total.....	21	19	5	4	31	10

Standard sized ice cubes made in any commercial-type refrigerator unit furnished a satisfactory supply of ice at all times. The cubes were not broken or crushed but utilized intact. A suitable number of cubes (3 to 6) are placed in immediate contact over the area to be anesthetized. The cubes are carefully arranged so that the entire area of the lesion is covered and is in direct contact with the ice. The ice cubes are maintained in position by several layers of gauze or a folded hand towel and held in position for 20 minutes with an elastic bandage when the position of the lesion permits it.

In lesions upon the neck, trunk and extremities, satisfactory superficial anesthesia, lasting from 15 to 30 seconds, can be obtained by this method. In those areas in which the skin is unusually sensitive and the blood supply abundant, the period of anesthesia is usually more brief than in less vascular areas.—
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USE OF HANGING CASTS IN COMPOUND FRACTURES OF THE HUMERUS

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and

MARK B. COVENTRY

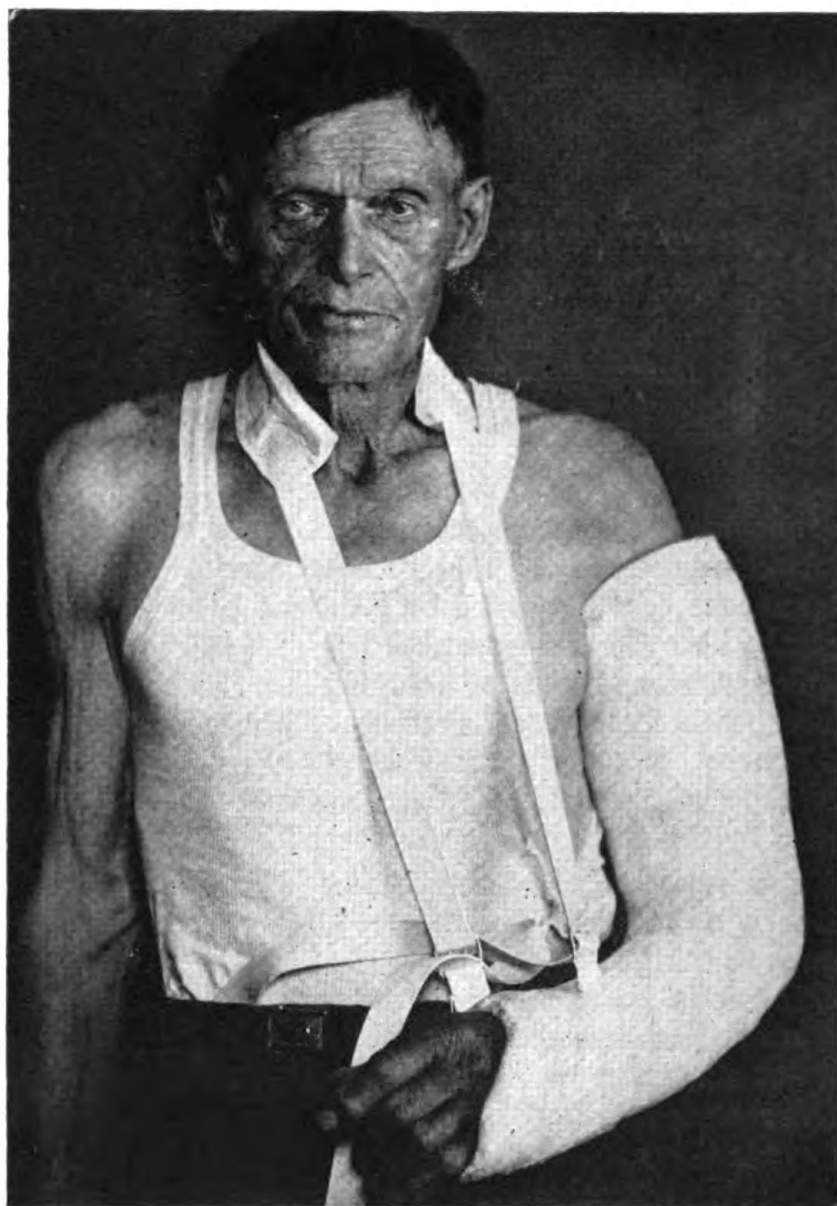
Lieutenant (MC) U.S.N.R.

The employment of plaster-of-paris casts as a means of continuous fixed traction in the ambulant treatment of fractures of the humerus was first suggested by Caldwell (1) and later elaborated upon by him (2) and by others (3) (4) (5) (6). It has become a quick, efficient means of handling such fractures sustained in warfare. This method lends itself readily to the teachings of Orr and Trueta, who have convincingly shown that compound fractures, especially compound fractures sustained in warfare, are best treated by the open method and closed plaster technic.

In the application of the hanging cast, slight traction is made on the arm by an assistant holding the elbow at right angles with the forearm in midpronation. The arm is covered by a stockinet bandage, if one is available, and sheet wadding. Extra padding is placed over the internal epicondyle and the olecranon process. The cast extends from just below the axillary fold to the wrist, and in those cases with an associated radial nerve palsy the cast should include the hand to the metacarpal phalangeal joints dorsally and to the finger tips ventrally, with the wrist in 45-degree extension and the fingers in slight flexion. A plaster loop or wire is incorporated in the cast at the wrist and a neck sling is attached to this loop. If available, a web strap with a buckle is convenient because correction of anterior or posterior angulation is facilitated by adjusting the length of the strap.

Abduction pads may be attached to the inner side of the cast at the indicated level to correct medial or lateral angulation. The patient should sleep in a semireclining position for the first few nights and, in addition, should be cautioned not to support the cast at the elbow. Although crepitus can be felt by the patient, pain usually disappears after a few days (fig. 1).

The cases shown in the accompanying illustrations represent the near-end and end-results of treatment by the hanging cast in



1. Hanging cast applied.

patients with fresh compound fractures of the humerus and elbow joint. The initial treatment in these cases was instituted at the scene of action in the form of first aid, in many instances by hospital corpsmen, and was followed in a period of from a few hours to a few days by local treatment and the application of a plaster-of-paris cast by medical officers—in most instances by medical officers aboard hospital ships. The initial casts in the majority of cases were not disturbed until the men were evacuated to this hospital, a period of approximately 6 weeks.

Upon removal of the casts the compound wounds were found to be completely healed in most instances. In the remaining patients



2. (Left) anteroposterior and lateral x-ray views 4 weeks following fracture. (Right) anteroposterior and lateral x-ray views 4 months following fracture.

the wounds have subsequently healed. In the instances in which healing had not taken place there were extensive wounds of the soft tissue. In none of the patients has there been associated osteomyelitis of any magnitude.

The position and alinement in all cases of fracture of the humerus in which joints were not involved have been satisfactory for good functional use of the extremity. The compound fractures involving the elbow joint were extensive in most cases. The patients treated with hanging casts have been ambulant. The wounds have healed without residual infection or osteomyelitis and in time will be receptive for any late surgical procedure deemed necessary.

From the series of patients seen here it is believed that the use of the hanging cast in the treatment of compound fractures of the humerus offers the simplest and most efficient method of handling such fractures in the combat zone. Several roentgenograms which are typical of all the cases are presented.

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ANTITRYPSINS IN STREPTOCOCCAL INFECTIONS

It is believed that streptofibrinolysin is a proteolytic enzyme closely related to trypsin, and that antitryptic titer of the blood is of clinical significance in streptococcal disease. If so, it should be possible to limit the spread of beta hemolytic streptococcal infections by regional or systemic administration of either pancreatic or soybean antitrypsin. The clinical value of this suggested possibility is now under investigation.—MANWARING, W. H.: Antifibrinolytic therapy. *California & West. Med.* 62: 53-54, February 1945.

ARTERIOVENOUS ANEURYSM OF THE BRAIN

BENJAMIN E. KONWALER

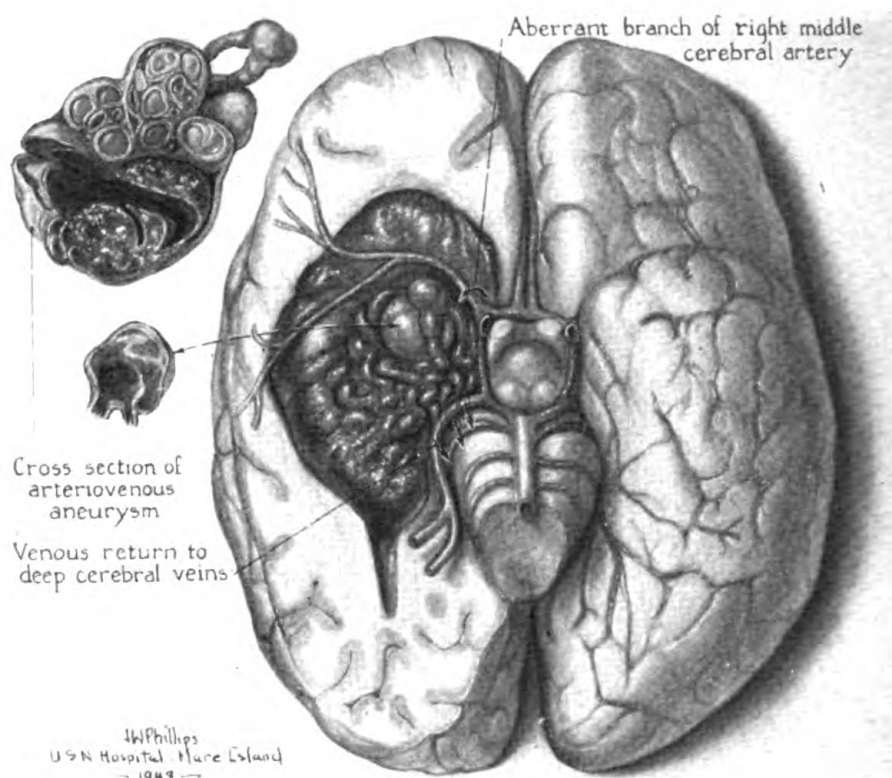
Commander (MC) U.S.N.R.

Arteriovenous aneurysm of the brain is not common. Less than 75 cases have appeared in the literature. Many of these have been studied only at operation, so that specimens for histologic study have not always been available.

Arteriovenous aneurysms of the brain are not true neoplasms in the sense of solid or cystic hemangioblastomas. Instead they are included in a group of vascular malformations along with telangiectases and venous angiomas. Unlike venous angiomas, however, arteriovenous aneurysms have not been observed in infancy. Yet it is thought that they are congenital in nature and that they have a tendency to remain symptomatically dormant for a number of years. Cushing and Bailey refer to the possibility of arteriovenous aneurysms arising as a result of the transformation of a venous angioma by trauma or pathologic fistula, thus accounting for the rather late appearance of symptoms. The basis for differentiation of an arteriovenous aneurysm from a venous angioma is the demonstration, either histologically or clinically, of arterial structures.

The following criteria for distinguishing between venous and arterial vessels are employed.

1. Character of the wall.
 - (a) Venous walls are much thinner than arterial walls and tend to flatten when empty.
 - (b) A vein has a much thinner media and much less elastic tissue than an artery.
 - (c) A vein has a relatively strongly developed adventitia.
 - (d) The adventitia, in veins, is composed of fibro-elastic tissue and nonstriated muscle fibers longitudinally placed.
2. Veins have no visible pulsation.
3. Arterial blood is bright red, and at operation may be seen with each heart beat pumping into and mixing with the dark venous blood of the arteriovenous aneurysm.
4. The relationship to the surrounding vascular system may be identified.
5. No bruit is heard over veins.

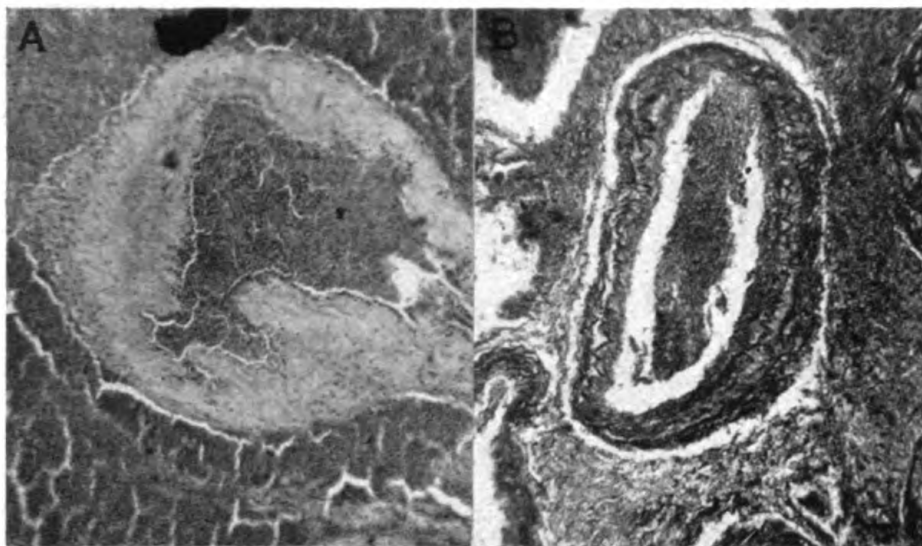


1. Arteriovenous aneurysm. Not visible externally and actually exposed only after removal of layers of blood clot.

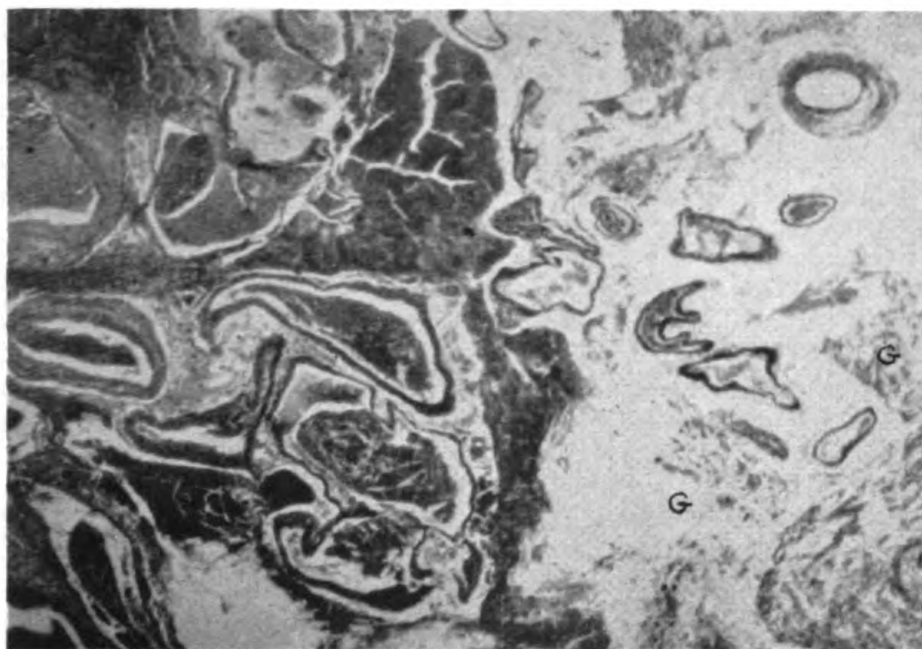
The significance of these findings at operation is apparent and the postmortem appearances give only a faint idea of what the actively pulsating snarl of vessels is like during life.

In contrast to hemangioblastomas, arteriovenous aneurysms are seldom encountered in the cerebellum, but are generally located in the cerebral hemispheres. Most of the patients do not develop symptoms until the third or fourth decade, possibly because by that time the degenerative changes in the walls of the vessels result in calcification or thrombosis, or a fistula develops. Dandy suggests that the space occupied by the lesions is compensated for in the early months of life when adjustment can readily be made during enlargement of the head. When symptoms appear, however, they may be indefinite, consisting of epileptiform seizures and some degree of motor or sensory disturbance. Possibly for the aforementioned reasons, signs and symptoms of severe intracranial pressure are uncommon and, as in the case to be reported, an intracranial hemorrhage may be the first significant incident; this may be followed by sudden death.

Grossly the lesion consists of an arterial branch or many



2. Low power. (A) Hematoxylin-eosin stain showing intimal thickening. (B) Resorcin-fuchsin stain showing imperfect, distorted, elastica interna.



3. Low power, showing collections of venous and arterial vessels. Note glial tissue at "G."

branches which lead into an inextricable coil of thin and thick tortuous vessels. These empty into a number of dilated veins. The lesion consequently consists of an arterial inlet and a venous outlet between which is the angiomatous mass constituting the actual enlargement. When a hemorrhage has resulted, this angiomatous mass may be buried under laminated layers of blood clot, so that unless sections are made the true nature of the lesion

may not be realized. When the clotted blood is removed, however, the aneurysmal dilatations become strikingly evident (fig. 1). Some of the vessels may be large and have thick walls, whereas others have thin, translucent walls.

Microscopically both arterial and venous elements can be found (fig. 2). Pathologic changes are frequent in the vessel walls, consisting of intimal thickening, imperfect or distorted elastica interna, or degenerative changes. Sometimes the intimal thickening is so great that narrowing of the lumen is considerable (fig. 2A). Degenerated neuroglia can be demonstrated among the vessels (fig. 3).

Case report.—A 41-year-old Navy yard worker was transferred via ambulance from the dispensary to the Naval hospital. He had fainted while at work and when brought to the dispensary was unconscious. When seen in the ambulance, he was lying on his right side with his head thrown back, his arms flexed on his chest, and there were transient, spastic, extensor tremors of the left leg. His respiration was irregular, and expiratory râles could be heard. Further examination, after admission to the hospital, revealed a weak but regular pulse with a rate of 60. Blood pressure was 134/60. No lacerations or signs of skull fracture were found but a small hematoma was seen over the right occipital region. There were blurring and engorgement of the retinal vessels but no papilledema. Superficial reflexes were present, active and equal on both sides. Deep reflexes were hyperactive. Babinski's sign was absent and repeated blood pressure observations showed a fluctuation in the systolic reading varying from 140 to 180.

Shortly after admission a consultant neurologist noted the patient as comatose, with dilated, inactive pupils and pronounced conjunctival injection. The fundi showed two large hemorrhages on the right but none on the left side. Neck rigidity was absent and notwithstanding hyperactivity, no pathologic reflexes were noted except a bilateral spread of the toes on plantar stimulation. The cerebrospinal fluid was bloody with a pressure of 540 mm. of water. No hemolysis was noted. The diagnosis of subarachnoid hemorrhage, possibly following a congenital aneurysm, was made.

Laboratory studies included a negative blood Kahn test, two-plus sugar in the urine, an erythrocyte count of 4,496,000, and a leukocyte count of 20,000 with a normal differential. Blood nonprotein nitrogen was 44 mg. per 100 cc., sugar 131 mg. per 100 cc., and a blood alcohol test was negative. About 10 hours after admission the patient became pulseless, respirations became irregular, and he expired.

Autopsy findings.—Aside from the cerebral changes, the only significant findings were a pronounced pulmonary edema, a healed duodenal ulcer, and widespread hemorrhage into the medulla of the left adrenal.

The brain weighed 1,620 grams. There was edema of the cerebral hemispheres with flattening of the convolutions and narrowing of the sulci. There was a striking varicosity of the veins at the base of the brain. The vessels forming the circle of Willis showed no gross abnormality nor was any disturbance found in the venous sinuses. On coronal section, however, the right lateral ventricle was distended with blood and blood clot. On carefully removing the clot, there was exposed a firm collection of vascular structures (fig. 1), some of which had thick firm walls as seen in the arteries, and others

had thin venous-like walls. A number of thin-walled vessels led from the main collection to communicate with the inferior cerebral veins. Several small branches of the middle cerebral artery were included in the blood clot mass, apparently forming the arterial or inlet branches of the arteriovenous aneurysm. The choroid plexus was also partially included in the blood clot. The left ventricle showed a small amount of blood clot, but there was no distention or involvement of the choroid plexus on this side. A moderate dilatation of the third and fourth ventricles was present. The pons showed some softening in the region of the fourth ventricle.

Grossly, therefore, the findings in the right lateral ventricle were those of an arteriovenous aneurysm, with branches of the middle cerebral artery acting as the inlet branches and with venous tributaries, leading into the deep cerebral veins, acting as the outlet. An interposed bed of tortuous vessels, forming an angiomatous mass, took the place of the normal capillary bed. The right middle cerebral artery was only slightly more prominent than the left. The varicose dilatation of veins at the base of the brain resulted from the increased intravenous pressure.

Microscopic examination of the angiomatous mass revealed the typical findings of arteriovenous aneurysm (figs. 2 and 3).

SUMMARY

A discussion of arteriovenous aneurysm of the brain is presented along with the characteristic gross and microscopic findings. A case is reported which illustrates the clinical and post-mortem findings usually encountered.



RAPID STOOL STAIN, IRON HEMATOXYLIN

The following rapid stool stain is a combination of two separate methods. The time consumed in making fixed preparations is less than a half hour as contrasted with the hours required by other methods.

The procedure is as follows (each step taking two minutes): Schaudinn's solution (60° C.), alcohol (70-percent), iodine alcohol, alcohol (70-percent), alcohol (50-percent), water rinse, iron alum 5-percent (60° C.), water rinse (60° C.), hematoxylin 0.1-percent (60° C.), water rinse, alcohol (95-percent), acetone, xylol, mount in balsam. At no time during staining is the slide allowed to dry. Schaudinn's solution is prepared by using saturated mercuric chloride 2 parts, 95-percent alcohol 1 part, glacial acetic acid 10-percent by volume. The iodine alcohol is made by adding iodine to 70-percent alcohol until port wine color is obtained. The hematoxylin solution consists of 10-percent aged alcoholic hematoxylin 0.4 cc., glacial acetic acid (prepare fresh) 0.8 cc., and distilled water (each time) 40.0 cubic centimeters. The iron alum is a 5-percent aqueous ferric ammonium sulfate (violet crystals) and makes a stable solution. The cysts and flagellates stain well, and nuclei are pronounced although not permanent.—SHAPER, A. A., Lieutenant Commander (MC) U.S.N.R.

ADULT CIRCUMCISION

REPORT OF 854 OPERATIONS ON NAVAL RECRUITS

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Circumcision was probably first performed for hygienic reasons and for personal cleanliness, but over the centuries it has assumed a religious and national significance among certain peoples. This is particularly true of the Hebrew race, which has performed the operation of circumcision on all male infants without any essential alteration in technic since Old Testament days.

Notwithstanding the centuries of experience with circumcision by many different peoples, present-day authorities write "that the end results of circumcision as seen in private practice are to be deplored." This is particularly true in adult circumcision, where the factors of growth and time do not materially improve the appearance of the surgical end-result. The authors' experience with 854 cases is presented in an attempt to evaluate different technics, instruments and anesthetic agents.

In these days of war it is important that no man be on the sick list unless it is imperative. Consequently circumcisions at sea were done under local anesthesia during the afternoon, and on the following morning at 0800 the men returned to duty. In this way the ship's routine and ability to fight was interfered with as little as possible. Not one of the patients spent a day on the sick list and all were able to do their duty in a satisfactory manner during their convalescence. These 31 cases (referred to as Group 1) will be used for comparison with the remaining 823 patients operated upon ashore.

Of the 823 men submitting to circumcision in 1 year at a U. S. Naval dispensary, 75 percent had a diagnosis of phimosis. In these cases the foreskin could not be retracted over the glans penis either by the patient or the attending medical officer. In a majority of instances this had been the situation for as long as the patient could remember.

Twenty-one percent of the 823 patients were admitted with a diagnosis of redundant prepuce. In many of these the foreskin was retracted for the first time in the patient's remembrance at the time of physical examination. Many were extremely redun-

dant and a majority of the patients had had one to several attacks of balanitis.

Two percent of the total series had an acute paraphimosis on admission and were so classified, and another 2 percent were listed as verruca acuminata, nonvenereal.

Careful preoperative preparation was carried out, and local (1-percent procaine hydrochloride) anesthesia was used on 366 patients (Group 2). The technic of operation varied slightly with different operators but a dorsal slit was done in all cases followed by removal of the redundant prepuce with scissors, accurate hemostasis and a reapproximation of the mucous membrane and skin with sutures of plain 00 catgut. A small piece of gauze covered with a bland ointment was placed over the line of suture and a firm circular bandage applied. The patients were allowed to remain in bed for 3 days following operation, the original dressing being left in place until the fourth day unless swelling or pain intervened. After the first dressing, dry gauze dressings were utilized to obtain a dry wound as rapidly as possible. No patient was allowed to return to his station until the incision was completely healed. This averaged 14 days.

Because it was thought that local infiltration with the procaine might be partially responsible for postoperative edema and tardy healing, spinal anesthesia, using 50 mg. of procaine, was employed instead of local. Two hundred twenty-one consecutive patients (referred to as Group 3) were operated upon with this revised technic. The average healing time in this series was 10 days, a saving over the previous group of 884 man-days. In 165 of these cases the dressing was a piece of dry gauze which was tied over the wound by means of four sutures, the ends of which were left long (fig. 1). In these cases the healing time averaged $10\frac{1}{3}$ days. In the remaining 56 cases a piece of gauze impregnated with a bland ointment was placed over the line of suture and fixed by a 1-inch circular bandage. In these cases the average healing time was 9 days. It was our impression that the "tie-in" type of dressing as noted in figure 1 predisposed to infection and delayed healing time.

In 136 cases a special type of clamp (Gomco) was used, with healing time averaging slightly over 10 days. We observed no decrease in postoperative pain, hemorrhage, edema, or infection in this series of cases. End cosmetic results compared with those in Group 2 were not found to be superior. If the frenum was very short, the clamp aggravated this situation, or if the clamp was tilted to remove as little as possible of this important structure, too little foreskin was removed. If the frenum was abnormally short-

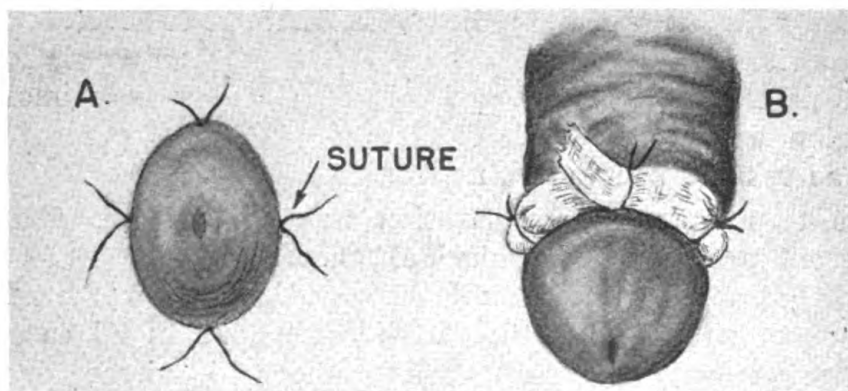


Figure 1.

ened, this area may separate following the operation and healing will be delayed while it slowly heals by granulation.

Operative time using the Gomco clamp was shortened from 25 to 40 percent and this was the only real advantage we could attribute to this special instrument.

Group 5 consisted of the final 100 consecutive cases in our series. Local anesthesia (1-percent procaine to which from 10 to 12 drops of epinephrine hydrochloride per 30 cc. of solution were added) was employed. In no cases was more than 5 cc. of

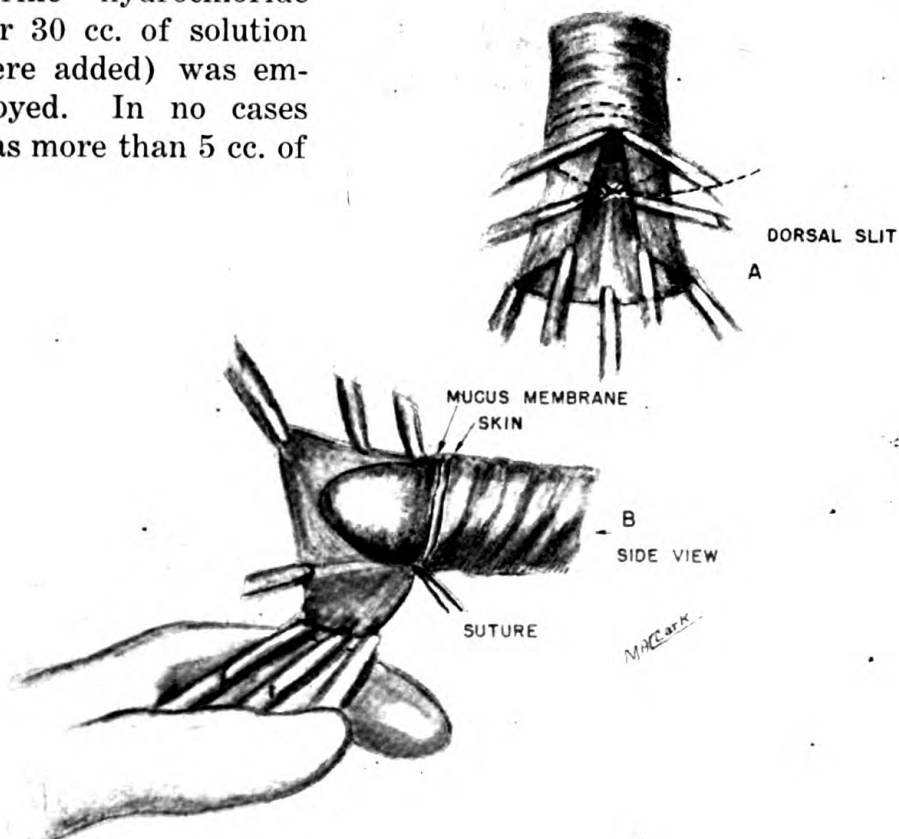


Figure 2.

anesthetic solution utilized, in order to minimize distortion and trauma of tissue. In all cases satisfactory anesthesia was obtained.

The operative technic employed in these 100 cases is shown in figure 2. Two hemostats are placed close together on the edge of the dorsal foreskin and the dorsal slit is begun with a scissors. From time to time the foreskin is retracted back over the glans penis and the slit is continued until the mucous membrane is incised to within from $\frac{1}{2}$ to 1 cm. of the corona. The outer or skin flap of the prepuce is further incised for a variable distance of one or more centimeters depending upon the redundancy of the skin. Hemostats are then placed approximating the skin and mucous membrane on either side of the upper angle of the dorsal slit.

Another pair of hemostats approximating the skin and mucous membrane is placed midway between these hemostats and those placed at the beginning of the dorsal slit. The assistant holds a clamp attached to the edge of the foreskin at the ventral midline under moderate tension, and the operator holds the three clamps attached to one or the other skin flaps formed by the dorsal slit under similar tension. The cutaneous flap of prepuce is separated from the mucosal flap and the cut is continued along the bulge of the corona, which is seen as a circular prominence under the penile skin.

The incision, circular on the dorsal aspect of the penis, is shaped like an inverted V on its undersurface following as it does the converging lips of the corona of the penis. The incision is carried to the midline on the ventral aspect of the foreskin. The internal flap of foreskin is then cut, leaving a border from the corona $\frac{1}{2}$ to 1 centimeter in width, with the frenum shortened or allowed to remain long as the anatomic circumstances indicate. The other flap of foreskin is handled in the same manner.

It was found that it was always necessary to place two or three ligatures in the frenular area to obtain hemostasis. In this circumscribed area the ligatures were very close to the incision and the relatively bulky knots of catgut delayed healing.

A needle was passed deeply through the subcutaneous frenular tissue, taking care to avoid the urethra, and passed back very superficially under the skin and out the same opening, following which the suture was tied. This was placed after the dorsal slit and before the remainder of the amputation was completed. It was placed nearer the corona than that point where the eventual circumcision would terminate. This technic tends to prevent shortening of the frenum.

No bleeding points at the frenum were then encountered and a smooth line of incision resulted. No vessels on the mucous mem-

Analysis of results by groups

Group	No. of days	Average days	Dressing	Anesthesia	Method	Preparation
1	31	None	Bland ointment and circular dressing as in fig. 2	Local infiltration 1% procaine	Dorsal slit; amputation of 2 flaps; suture of cut edges	Soap and water; tincture of merthiolate; sterile linen.
2	366	14	As in fig. 2	Local infiltration 1% procaine	Dorsal slit; amputation of 2 flaps; suture of cut edges	Tincture of merthiolate; sterile linen.
a	165	10.3	Tie-in dressing as in fig. 1	Spinal (50 mg.) procaine	Dorsal slit; amputation of 2 flaps; suture of cut edges	After dorsal slit, glans, foreskin, and penis washed with soap and water; redraping with sterile linen; change of gloves and instruments.
b	56	9	As in fig. 2			
a	121	10.2	As in fig. 2	Spinal (50 mg.) procaine	Gomco clamp	After dorsal slit, glans, foreskin, and penis washed with soap and water; redraping with sterile linen; change of gloves and instruments.
b	15	10	As in fig. 2	Local infiltration 1% procaine		
5	100	9.6	As in fig. 2	Local infiltration 1% procaine; no more than 5cc.	As in Group 1 plus added features. See discussion Group 5	After dorsal slit, glans, foreskin, and penis washed with soap and water; redraping with sterile linen; change of gloves and instruments.

brane flaps required ties and those on the skin side were ligated with 00 plain catgut. The skin edges were approximated with 8 or 10 sutures of the same material and ointment-gauze dressing was applied.

The healing time in these 100 cases was 9.6 days, which is more favorable than the over-all average of Groups 3 and 4. The average healing time of 111 Negroes who fall into Groups 3, 4, and 5 was 8.2 days. No attempt will be made at this time to explain this interesting observation.

SUMMARY

1. A series of 854 adult patients subjected to circumcision is reported; of these the majority were admitted with a diagnosis of phimosis.

2. Postoperative edema and infection were persistently the most frequent complications encountered. The methods used in their prevention are outlined.

3. A comparative series of cases using the Gomco clamp and standard circumcision technics are reported.

4. A technic for the prevention of frenular hemorrhage is described.

BUFFER PRECIPITATION TEST FOR MALARIA

EMIL BOGEN

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A typical case of malaria may be readily recognized by the clinician. The history of exposure or of previous attacks, the characteristic, regularly recurring paroxysms of chills and fever, with relative well-being on the intervening days; the splenic enlargement and anemic cachexia, and the rapid response to specific therapy form a classic picture. Malaria, however, does not always follow this textbook sequence.

The patient may be seen in his first attack, without history of previous chills and fever; the infection may be multiple so that intervening days are not afebrile; the symptoms may be atypical, as fever without rigors, or respiratory disturbances, suggesting that the chill may be due to pneumonia, or other infection; the early, soft, slight enlargement and tenderness of the spleen may be easily missed, and the large, hard spleen and cachexia of old neglected infections are absent in most of the cases encountered in the service. As a result, many patients with malaria are admitted to Naval hospitals under different diagnoses, while many cases are mistakenly called malaria which are really other maladies.

The discovery of the malarial parasites in the blood smear is one of the most important and reliable laboratory aids in medicine, but even this test is not infallible. Early in the disease, in old chronic cases, during remissions, in the intervening days between falciparum paroxysms, and when the patient is undergoing atabrine or quinine suppressive or therapeutic dosage, parasites in the circulating blood are often extremely rare (1). It is for this reason that the thick smear, which enables the technician to examine much more blood than did the older method, is now generally employed. Methods of concentration by differential centrifugation, or by lysis of the red blood cells, have been presented by many workers in the effort to increase the number of positive findings. But still some cases of undoubted malaria escape confirmation.

Nearly all, if not all, cases might yield positive results with sufficiently repeated, persistent, and expert search of well-stained thick and thin blood smears. Unfortunately, however, this re-

quires more time, labor, and technical skill than is usually available. Many positive smears are obtained only after repeated negative reports, with consequent delay in instituting therapy and protective measures, and others escape recognition entirely, as the disease remits spontaneously or as a result of the routine suppressive atabrine dosage, before a positive smear can be found. In troops returning from the South Pacific, repeated smears taken over a long period of time may be negative, yet months later the patient's chills may recur, or even appear for the first time. Microscopic studies usually fail to disclose such latent infections. Perhaps some other method might be more effective.

A variety of standard immunologic technics, including complement fixation, and precipitin tests, have been proposed (2) for the diagnosis of malaria, but the difficulty in obtaining specific antigens, and the variability of the results obtained have precluded their general use. A nonspecific procedure has given more promising results. Henry observed flocculation of blood serum in an aqueous extract of melanin, derived from the eye of an ox, in a high proportion of malaria patients, and in only a few controls. Chorine and Gillier (3) showed that this flocculation was due to the distilled water with which the extract was made, rather than to the melanin itself.

In 1939 Wolff (4), city bacteriologist of Colombo, Ceylon, reported that blood serum added to buffered distilled water became cloudy at a higher pH in malaria than in normal controls. The following year he described a simple buffer precipitation test, using only a few drops of serum and requiring little technical labor (5). The reaction is apparently due to a euglobulin which arises in the blood of malaria patients, but whether it is a product of living or dead parasites or of the tissues damaged by them, or an antibody produced in response to the infection, is not yet known. Even though this test may merely indicate that infection has occurred sometime in the past, as with the tuberculin test, rather than prove the presence of active or potential disease, extensive experience at this hospital has already demonstrated its practical value.

Buffer precipitation test (Wolff's B.P.T.).—The buffer precipitation test is performed as follows:

1. Several cubic centimeters of fasting venous blood are collected, allowed to clot, and the clear serum is separated, using gentle centrifugation if necessary.
2. One cc. of Test Buffer Solution A is placed in a small test tube, such as is used in the Kahn test, in the front row of a test tube rack. This solution is made by adding one part of a stock buffer solution with a pH of 7.7 to four parts of distilled water and then adding 0.2-percent formalin as a preserva-

tive. A convenient stock buffer solution is that of Clark and Lubs, prepared by adding 43.95 cc. of M/5 sodium hydroxide to 50 cc. of M/5 potassium acid phosphate and diluting to 200 cc. with distilled water.

3. One cc. of Control Solution B is placed in a similar test tube, in the rack behind the corresponding Test Solution A tube. Control Solution B consists of one part of a stock buffer solution with a pH of 7 added to four parts of distilled water and five parts of isotonic (0.85-percent) sodium chloride solution, to which 0.2-percent formalin is then added. Clark and Lubs' stock buffer solution of pH 7 contains 29.54 cc. M/5 sodium hydroxide and 50 cc. of M/5 potassium acid phosphate, diluted to 200 cc. with distilled water.

4. Two drops of clear serum are then placed in the test tube containing the Test Buffer Solution A and another two drops of serum are placed in the test tube containing the Control Solution B. A medicine dropper may be used in many tests if it is carefully rinsed with distilled water after each sample. The tubes are then well shaken by hand, left standing at room temperature for approximately one hour, and then read.

Reading the reactions.—The average positive test may be recognized almost immediately, but weak reactions develop slowly, so the reading is deferred until from 30 to 120 minutes after the addition of the serum. The observation is best done by daylight, holding the two tubes side by side and looking through them at the lower part of a window frame, although artificial light may be used with a similar arrangement.

Particulate precipitation, as with the Kahn test, does not occur, but readings are based on the diffuse cloudiness of the solutions. They may be recorded as negative (—) or clear, trace (\pm) or opalescent, weak (+) or light cloud, strong (++) or heavy cloud, and hyperflocculation (+++) or opaque. The test depends upon comparison of the test tube and the control, so it may be better to note the difference between the appearance of the two tubes rather than their actual densities, especially when the control tube is not absolutely clear.

The buffer precipitation test, according to Wolff, is positive in almost all cases of malaria, except during actual paroxysms, and rarely positive otherwise, except in kala-azar, typhus fever, leptospiral jaundice, and some forms of liver disease. Hemolysis, lipemia, bacterial growth, and other sources of turbidity in the serum may make the test unreadable by producing heavy turbidity in both tubes, but the use of a control tube obviates false positive reports from this cause. Simple hemolysis, accidentally or experimentally produced by mechanical, thermal and chemical technics, here failed to produce false positive results or to obscure a true positive reaction. Doubtful test results were seen, however, in a few patients with previously negative reactions following blood transfusions from donors who showed no sign of malarial infection.

CLINICAL CORRELATION

More than 3,000 buffer precipitation tests have been performed at this station during the past year, including 244 tests on persons known to have had malaria then or at a previous time, and 170 tests on natives, among whom malaria is known to be common. More than two hundred tests repeated on the same serum, or on the same individual after a short interval, usually confirmed the previous finding. The results of these tests are shown in the accompanying table.

TABLE 1.—*Buffer precipitation tests*

	Negative	Doubtful	Weak positive	Strong positive	Total
Active malaria (within 1 month).....	7	10	10	48	75
Recent malaria (1 to 6 months).....	3	31	14	12	60
Old malaria (6 to 12 months).....	13	60	25	11	109
Total known malaria.....	23	101	49	71	244
Natives (suspected group).....	26	69	47	28	170
Others (no known malaria).....	2,047	432	76	40	2,595
Total.....	2,096	602	172	139	3,009

The majority of tests performed on patients with active cases of malaria, with positive smears reported within the same month, gave strongly positive results; only 15 percent were doubtful and less than 10 percent were negative. During the first 6 months after a positive smear, the positive reactions became weaker, and in those tested more than 6 months after the subsidence of clinical and microscopic findings the majority showed doubtful reactions; results in the others had become negative. Among the natives, who were all working and apparently asymptomatic, but in whom positive blood smears could sometimes be obtained and enlarged spleens were occasionally observed, the majority gave doubtful or weak reactions, but about one-sixth gave strongly positive reactions.

On the other hand, in more than 80 percent of the persons not known to have had malaria, test results were negative and in less than 2 percent were strongly positive. Most of these control subjects were under atabrine suppressive treatment, and many had been exposed to malarial infection in the South Pacific islands previously, so that some at least of the positive and doubtful reactions in this group probably represent latent or unrecognized infections rather than false results. In one thousand hospital patients without recognized malaria, but suffering from neuropsychiatric disturbances, skin lesions, tuberculosis and other diseases, as well as battle casualties, positive tests were no more frequent than in a similar number of healthy volunteer blood

donors. Only 3 positive tests were found among 20 cases of tsutsugamushi fever and coincident malaria could not be ruled out in these instances.

The positive finding of cloudiness in this test is not as critically conclusive as is a positive blood smear for malaria, but a negative finding may be even more reliable. A strongly positive test generally indicates that the individual has been infected with malaria and a completely negative test tends to exclude such a diagnosis. Such tests have a high pathognomonic significance, and false findings are relatively uncommon. Weak and doubtful results, however, must be interpreted in terms of relative probabilities.

The buffer precipitation test should not be used as a substitute for blood smears in the diagnosis of malaria, but rather as an addition to our diagnostic armamentarium. The technical simplicity and high sensitivity of the test make it especially valuable for arousing suspicion of the disease, as a presumptive test in suspected cases, and as a check upon questionable or inconsistent microscopic findings. A positive smear for malaria may be often recognized without delay, but a slide must be examined for some time before it may safely be pronounced negative.

When materials and equipment are available, a technician may perform hundreds of buffer precipitation tests at a time, and when the blood sera have already been obtained for Kahn tests or blood matching, the actual procedure may require less than a minute of additional labor. Only the doubtful or positive tests need ordinarily be given the more time-consuming, blood smear microscopic examination.

GROUP TESTING AND PROGNOSTIC SIGNIFICANCE

Routine testing of all patients admitted to hospitals, returning servicemen, and other groups who may have been exposed to malaria might reveal many an unsuspected case of malarial infection, and allow the diagnosis to be established before symptoms appear. In groups in which malarial infection is not common, a positive or even a doubtful reaction points out most of the few individuals in whom further blood studies are indicated, and greatly reduces the labor expended in their recognition. In our experience only one percent of the subjects with negative buffer precipitation tests had a diagnosis of malaria, and less than a third of one percent had active disease at the time of the test.

The buffer precipitation test may be especially valuable as a screen for the selection of blood donors for plasma or whole blood transfusion purposes. A few drops of the serum separated for

the Kahn test are taken for a routine buffer precipitation test at this hospital. A positive or doubtful test is an indication for rejection or further investigation of the prospective donor, both to prevent the possible transfer of malaria to the recipient, and to prevent the outbreak of clinical disease following the bleeding in a donor with latent infection. Routine microscopic examination of the blood of all prospective donors may not be feasible, but even when combined with a negative clinical history, appears to offer less assurance of the absence of malarial infection than does the negative buffer precipitation test.

Further study is necessary to evaluate the utility of the buffer precipitation test in following the course of malarial disease, in guiding therapy and in certifying cure. How early the reaction develops in initial infection with the malarial organism, how long it may remain positive after the symptoms subside and the blood smears become negative, and what may be the findings in prolonged remissions in cases which will eventually recur have not yet been determined.

Positive buffer precipitation tests were obtained in some patients in the present series before a positive blood smear had been found, in many after the blood smears had become negative under treatment, and in some patients who exhibited clinical characteristics of malaria but in whom no positive smear had ever been reported. A few subjects were positive between recurrent malaria attacks, but since the intervals were not long they may have represented merely the residuum of the earlier active disease, rather than any indication of latent infection.

It is hoped that a large number of such tests may be performed on troops who have been exposed to malarial infection, and on persons apparently cured of the disease who are discontinuing the use of atabrine or other suppressive drug. Follow-up of such persons would be of particular value in ascertaining whether the test has any value in indicating cases in which clinical disease is apt to appear for the first time, or to recur after prolonged latency or suppression.

EPIDEMIOLOGIC EMPLOYMENT

The buffer precipitation test may be of greatest value in measuring the incidence of malarial infection in a community, instead of, or in association with the examination of blood smears and the determination of the index of splenic enlargement. Tests of natives here have shown an extremely high incidence of infection, which is only suggested by the findings on microscopic examinations and the occasional instances of splenomegaly. The need for

special antimalarial precautions and for suppressive treatment in an area may thus readily be determined by the results of the test in the indigenous population. Extensive studies of whole populations or of representative groups, made feasible by the use of this test, may yield results of wide epidemiologic significance.

The buffer precipitation test may also be effectively employed in military malaria control. For example in troops moving into a nonmalarious zone, the test may indicate which groups have been previously widely seeded with malarial infection, and which are still untouched. Atabrine suppression may be controlled accordingly. In a unit whose tests are generally negative, the suppressive treatment may be discontinued safely as soon as they leave an infectious region. If many positive reactors are found, the suppressive treatment should be maintained until facilities are available for the care of the large number of cases of clinical malaria which may be expected to develop.

SUMMARY

A simple, sensitive serologic test for malarial infection has been discovered. Wolff found that normal human blood serum, added to distilled water at pH 7.7, remains clear, but blood serum from malaria patients becomes cloudy. From this observation the buffer precipitation test has been developed. More than three thousand such tests made at this hospital have confirmed the validity of this reaction. The reaction is strongest in active malaria between paroxysms, and in recently recovered patients, but remains positive, though weaker, for many months.

The test offers valuable aid both in individual diagnosis and in the detection of malaria in large groups. It may have interesting possibilities in suggesting prognosis, in guiding suppressive and therapeutic measures, and in evaluating cures. Its epidemiologic application may also contribute to the control of malaria in the armed forces.

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MALARIA EPIDEMIC ABOARD AN LST

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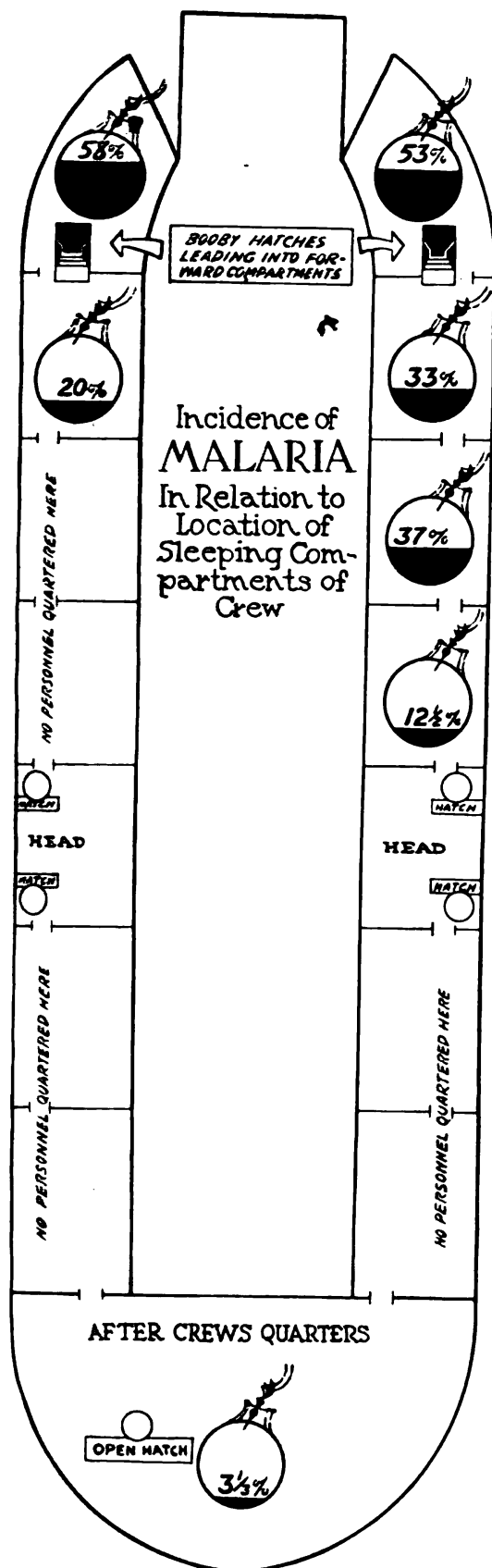
The development and widespread use of amphibious craft have introduced new problems of malaria control. That constant attention to these problems is a military necessity was recently demonstrated by the occurrence of an epidemic of malaria aboard an LST operating in this area.

During the 8-day period from 14 May to 22 May 1944, twenty-five members of a crew of approximately one hundred men were admitted to the sick list with a clinical diagnosis of dengue. Eighteen of these men were subsequently readmitted here, and in seventeen instances the diagnosis of malaria was established by blood smear. A clinical diagnosis of malaria was made in the remaining cases. All the patients responded satisfactorily to treatment with quinine or atabrine, or both. *Plasmodium falciparum* was demonstrated in thirteen of the blood smears and *Plasmodium vivax* in four. Movements of the ship prevented laboratory study of men not admitted as patients here, and also of the clinically well members of the crew.

Amphibious Force personnel comprises the majority of patients seen at this activity, and although sporadic cases of malaria have appeared, the number has been remarkably small. The utilization of control measures, approaching those recommended for forces ashore, doubtlessly accounts for this low incidence. The epidemic occurrence of this disease aboard a single vessel seemed, therefore, to warrant investigation.

The LST had been operating in a highly malarious zone for several months (from 50- to 100-percent endemic infection of the native population having been demonstrated by prewar surveys). The men had been allowed ashore for recreation occasionally, but rarely at night and only in areas where malaria control measures had been instituted. Three of the patients had not been ashore for 2 months or more prior to the onset of symptoms. No correlation could be established between the degree of exposure ashore and the presence or absence of clinical malaria.

Atabrine had been made available at meals but compliance with



the recommended dosage was apparently a matter of individual discretion. Nine of the patients readily admitted having taken 0.1 gm. or less weekly, an equal number had taken 0.3 gm. weekly, and seven stated that they regularly complied with the recommended dosage of 0.6 gm. weekly. In only 28 percent had suppressive chemotherapy been "adequate." These men tended to develop clinical symptoms 2 or 3 days later than the remainder.

It was noted that many of the men having malaria had occupied the same or adjacent sleeping compartments (see accompanying diagram). More than 50 percent of the men in the first compartments forward had developed malaria. Large booby hatches, open whenever possible for ventilation, lead from these compartments to the main deck. The attached screen doors were said to have been habitually not used. Small escape hatches leading into other compartments were often open and the screens were missing.

Despite the inadequacy of protective screening, mosquitoes had rarely been observed aboard ship. However many recalled that on the night of 4 May 1944, during beaching and unloading operations in an uncontrolled, highly malarious area, the forward sleep-

ing compartments were invaded by large numbers of mosquitoes. The insects were so numerous that men in these spaces moved to other parts of the ship in order to sleep comfortably. The following day the ship was thoroughly sprayed with an insecticide. Ten days after this mosquito invasion clinical symptoms of malaria appeared and, within a week approximately 25 percent of the crew was disabled.

COMMENT

Of the factors involved in this outbreak the relative vulnerability of an individual's sleeping compartment to mosquitoes appears most significant. The simultaneous exposure of many men to infected mosquitoes accounts for the "epidemic" character of the outbreak. The inadequacy of the suppressive chemotherapy in the majority of these cases is undoubtedly the most important contributory factor.

Naval forces afloat in malarious zones derive considerable protection from the fact that mosquitoes, under ordinary circumstances seldom venture more than $\frac{1}{2}$ mile offshore. Personnel aboard amphibious craft, however, may frequently be brought into intimate contact with the vectors of malaria. Failure to combat this hazard may result in the temporary disability of an actively operating ship.

Amphibious craft operate much of the time in areas untouched by the efforts of malaria control organizations. Under such conditions the problems of men aboard these craft are at times similar to those of combat forces ashore. At intervals amphibious craft may enjoy the same relative security from mosquitoes as do other Naval vessels. The rules of good antimalaria discipline should, nevertheless, be continuously enforced.

Closely supervised suppressive chemotherapy and other individual protective measures (proper clothing, netting, chemical repellents) are of well established importance. More attention should perhaps be directed to the equally important, and probably more effective, measures of environmental control, with particular emphasis on the maintenance of protective screening and the regular use of insecticidal sprays in malarious areas.

QUININE AND ATABRINE

DEVELOPMENT AND PRESENT APPLICATION

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Although malaria is one of the most ancient diseases of mankind, a remedy with specific action against the parasites awaited the discovery of the New World. The use of cinchona bark goes back to the sixteenth century when Peru began exporting it to Europe. Then quinine was isolated in 1820 and the forests of Ecuador, Peru, and Bolivia were stripped to meet the demand. The South American sources, lacking a sound conservation policy, were already failing when the Dutch, and later the British, initiated production in the East Indies and neighboring countries. The British cinchona industry in India and Ceylon went down in a crash of overproduction during the closing years of the nineteenth century, but climatic advantages and scientific control saved the Dutch industry.

In 1913 the Javanese monopoly was signalized by an agreement between the producers of the bark and the manufacturers of the final product, which constituted not only a corner on the quinine of the world, but effectively discouraged experimentation in substitutes and synthetics. By 1933 the Dutch East Indies were producing annually 10 million kilograms of bark, almost five-sixths of the total world production.

Defendants of this cartel point to the establishment of high standards of quinine purity, and to the lowering of costs from around \$75 per kilogram in the eighties to about \$15 in 1926. They interpret the enormous profits of the industry as the successful result of great risk-taking and the reward of private enterprise. Critics of the cartel assert that the production of this health-saving commodity was deliberately held down, and that the drop in price was no philanthropic action but the result of economies in large scale production and the fear that a higher price would encourage attempts at synthesis.

Certain it is that the production of quinine fell far short of the world's needs, and millions could not afford it at the price demanded. A group of countries responding to a League of Nations inquiry in 1932, revealed that their annual imports scarcely reached 150,000 kilograms, whereas their peoples needed more than a

million. An editorial in the *British Medical Journal* in 1942 estimated that India, though producing only 70,000 pounds, needed a million pounds of quinine annually.

As long as quinine production was in the hands of the Dutch and under the aegis of the British Navy in India and the Far East, there was no fear that it might be used as a weapon of war. But with the rise of Japan as an aggressor nation and her gradual penetration southward, the vital military importance of the quinine monopoly became clear. Realization of this fact is reflected in the great rise of imports by the United States from the Netherlands Indies from an annual average of less than 1½ million pounds of the bark in the early thirties to almost 5½ million pounds in 1940.¹

While Japan was preparing to take the cinchona bark monopoly by conquest, Germany was busy by-passing the quinine monopoly through the production of synthetic substitutes. Though she had lost her colonies as a result of the first world war she was firmly resolved to regain them. Against that day her administrators planned to have an antimalarial drug which would make her independent of the Dutch monopoly and capable of exploiting to the full her hoped-for future tropical possessions. So she turned a part of her huge dye industry to the task of producing chemotherapeutic agents.

The synthesis of quinine itself was not one of the objects of this research. The technical difficulties were such as to make it unlikely that synthetic quinine could ever compete commercially with the natural product. Further, the experiences of the armies in World War I had shown how far short quinine fell from being the ideal antimalarial, or the specific it had been thought to be.

The Japanese did seize the quinine monopoly, and the Germans did produce in atabrine a synthetic superior to quinine. Had it not been for vision and initiative on our part, the antimalarials would have been a powerful military weapon against us, and our lack of them would have adversely affected our course in the war.

PROBLEMS IN MALARIA RESEARCH

Research in malaria bristles with difficulties. Plasmodia of the same general order as those found in man are to be found in reptiles, birds, and monkeys. Such a wide distribution in nature infers that this was a successful parasite of the wandering blood cell as far back as the Saurian Age. The parasites have been found in the blood of 130 species of birds, and in many species of primates.

¹ TEMKIN, O., and RAMSEY, E. M.: Antimalarial Drugs. Division of Medical Sciences of the National Research Council, Washington, D. C., March 1944.

Point 1: Such a successfully adapted and widely distributed parasite is not likely to be vulnerable to attack.

But these plasmodia of the so-called lower animals will not grow in man (with one exception); neither do they behave consistently in respect to each other. Point 2: It is impossible to predict whether results gained in research on bird and monkey malarias will apply to each other or to human malaria.

Furthermore no experimental animal will "take" human malaria, and no human malaria has ever been successfully cultured. Point 3: Man must be his own experimental animal and test tube.

These are tremendous obstacles to investigation, and doubtless partially account for much of our present lack of knowledge. The handicap is particularly obvious in the field of chemotherapy because of the law of "species susceptibility." One of the simian malarias, for example, is definitely cured by one dose of sulfanilamide, but the sulfonamides are only mildly effective in human malaria. Ethics forbids the preliminary trial of drugs on man himself, but how is one to determine the significance to human malaria of facts discovered about duck malaria in ducks? Malaria research is full of such shadow boxing, for it deals with a different parasite in a different host. It is as if research on human pneumonia were limited to experiments on mice infected with streptococci.

When the German chemists set to work on the chemotherapeutic problem they tested their drugs on a bird malaria in canaries, and discovered an effective aniline derivative called plasmochin; but subsequent experience with this drug in human malaria revealed serious shortcomings. In the years that have followed, its usefulness has gradually been reduced to a very narrow field. Their next discovery, however, was an astonishing success, as yet unmatched in antimalarials. The evolution of atabrine from an acridine dye through innumerable trials upon the parasites of lower animals was an achievement of primary magnitude. Although the formula for its content became known, the steps of its manufacture were patented and kept secret. The first atabrine to be made in the United States was produced in 1941, and it was some time later that its identity with the German product was established.

Malaria research developed a new and exciting angle after the last war, when malaria began to be used in the treatment of syphilis. These "induced" cases were a legitimate field for information on the biology of the parasite, the course of the disease in man, and the evaluation of antimalarial drugs under controlled conditions. The mental hospitals of many countries became foci

for malaria research, and their contributions soon reached large proportions.

One of the fundamental questions in malaria is the course of the parasite in man during that silent period between the moment of the mosquito bite and the appearance of chills and fever. This is the mystery of the so-called "inapparent phase." Earlier it was thought that the sporozoite, introduced in the salivary secretion of the mosquito, entered the red blood cell directly; but this theory had to be abandoned. In the course of time intermediate forms have been identified in several birds and at least one saurian. These so-called "exo-erythrocytic" (E-E) forms are closely related to the reticulo-endothelial system in the liver, marrow and spleen, and though no such forms have yet been identified in either simian or human malaria, some such "tissue phase" must be hypothesized.

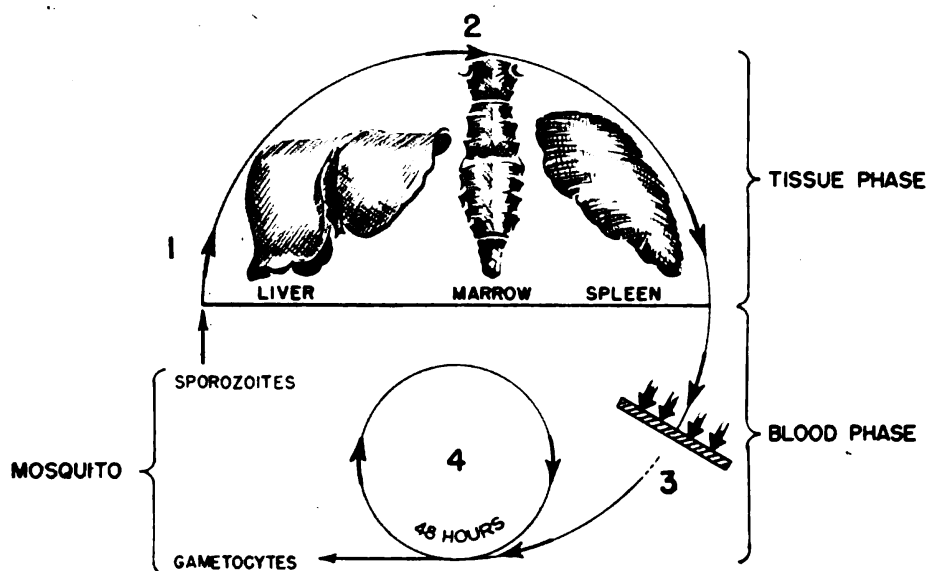
Malaria is therefore biphasic, part of the time in the tissues of various viscera, and part of the time in the blood. The next question to be faced was, what relation has tissue phase to blood phase? Here a crucial observation gave a clue to the answer. It appeared that patients acquiring so-called "trophozoite-induced" malaria by artificial transfer of blood from an infected case, could be cured promptly with an antimalarial, or soon got well without treatment, and never relapsed; whereas those patients given so-called "sporozoite-induced" malaria through the bites of artificially reared and infected mosquitoes had malaria strictly comparable to the natural type, prone to relapse and hard to cure.

The obvious interpretation of these facts is that malaria in man goes through a sequence of events which is not reversible. In the blood passed from donor to recipient there is lacking something requisite to maintain the disease in the recipient. The trophozoite of the blood phase cannot maintain itself. On the other hand the sporozoite, passing into the exo-erythrocytic or tissue phase, produces a disease persisting throughout a long period of successive relapses and showing marked resistance to treatment.

The fact evolves that relapses, i.e., trophozoites in the blood, arise and can only arise from a persistent tissue reservoir, from a form that no one has ever identified in man. In other words, as may be seen in the accompanying diagram, the cycle is always clockwise and never completed, for blood forms cannot change back into tissue forms. The cycle has to pass through the mosquito at this point.

The reason for apparent digression into the biology of the parasitic cycle in man is obvious when two facts are considered. One is that since the trophozoites always spill over into the blood from

DIAGRAM OF THE COURSE OF VIVAX MALARIA IN MAN



RELATION TO DRUG ACTION:

1. Prevention— No known drug acts here.
2. Cure — No known drug acts here.
3. Suppression— Atabrine acts effectively here, quinine less so.
4. Termination clinical cycle— Both drugs effective.

the tissue reservoir, trophozoite destruction can never cure the disease. More trophozoites will keep on coming. The other is that our two antimalarial drugs are only effective against the blood forms (one exception will be noted subsequently), and are not effective against the inapparent tissue forms of the parasite. Malaria, therefore, is like a hardy perennial, always ready to grow up from its roots in liver, spleen, and marrow, no matter how briskly and successfully quinine and atabrine lop off the apparent phase in the blood. The diagram and table help to make this clear.

What then does cure the patient of malaria, and prevent the disease from being a succession of relapses? And what then is the role of the antimalarials? The answer to these two questions is that the patient is cured by his own immunity, and that the role of quinine and atabrine is to restrict the activity of the disease and relieve the patient's symptoms while his immunity is gaining an effective level. Their function is not to cure, but to keep the infection at bay in the symptomless tissue phase while the body cures itself.

*Action of atabrine and quinine on the three
malaria parasites at the four crucial points of their life-cycle*

Drug action		Atabrine			Quinine		
<i>Note: a), b), c), d), in each bracket are equivalents of each other</i>		Plasmodium			Plasmodium		
		Viv.	Fal.	Mal.	Viv.	Fal.	Mal.
1.	(a) Causal prophylaxis (b) Kills sporozoites (c) Prevents infection (d) Result—no disease	0	0	0	0	0	0
2.	(a) Cure (b) Kills tissue (and ? blood) forms (c) Prevents relapse (d) Result—disease terminated promptly	0	±	0	0	0	0
3.	(a) Suppression (b) Kills early trophozoites (c) Prevents clinical attack (d) Result—clinical disease postponed	+	+	+	±	±	±
4.	(a) Terminates clinical attack (b) Kills blood forms (c) Prevents physical deterioration (d) Result—disease restricted	+	+	+	+	+	+

0 = ineffective
± = somewhat effective
+ = efficient action

Immunity in malaria is a topic of great complexity, and a few simple statements must suffice for this discussion. In the first place all uninfected human beings are susceptible to malaria. There are no natural immunes. Secondly immunity is in general of very slow and gradual growth, but varying widely as between the different species of malaria, and as between different individuals. Thirdly the immunity is homologous, never heterologous; in other words immunity to one species, or even to one strain, does not confer immunity to other species, or even to other strains. Fourthly immunity tends to fade unless continually stimulated by successive super-infections. That is, the highest immunities are found in the chronically infected residents of hyperendemic zones, and a patient removed from a malarious environment first recovers from his infection and then gradually loses the immunity by means of which he has recovered.

For example an effective immunity against falciparum malaria, which is usually acquired within 6 months, does not protect against a concurrent or subsequent vivax infection; and immunity against a Pacific strain of vivax—a particularly slow-growing immunity which in some individuals takes 3 years or more—does not necessarily protect against subsequent infections with American or Caribbean strains, or even against another Pacific infection if exposure is subsequently repeated. These facts and examples suggest how unpromising is the field of immune serums in the treatment of malaria.

The theoretician may ask, "Why treat malaria with drugs at all? If it is immunity that cures, and if drugs are mere adjuvants, might they not be dispensed with?" A few clinicians, indeed, have advocated leaving the paroxysms untreated on the assumption that this speeds up the production of immunity; but there is little to support this position. Rise in immunity seems to be closely related to the tissue phase of the infection.

The fact is that there are two urgent reasons for the use of drugs in malaria. One is that in falciparum malaria a serious condition of blocked capillaries may supervene in the untreated case, which may lead to death. The other is that the anemia and physical deterioration, which ensue in untreated malaria of any kind, are so rapid and so fraught with discomfort and risk to the patient that the clinician rightly counts on the antimalarials to save his patient's life. Thus what is theoretically merely a crutch becomes in actual practice a life buoy.

COMPARISON OF THE TWO ANTIMALARIALS

The advantages, disadvantages, and dosage schedules of quinine and atabrine were compared and the conclusion was drawn that both are extremely useful drugs in the treatment of malaria. No one is justified in wishing that either drug should entirely displace the other, or in predicting that this will take place. Atabrine, however, is definitely superior to quinine.

Quinine is quickly absorbed and rapidly builds up an effective blood level. Therefore the present dosage is 15 grains three times daily for 2 days, followed by 10 grains three times daily for 5 days, making a total of 240 grains in 7 days.²

Atabrine is also rapidly absorbed, but is distributed to the tissues and builds up an effective blood level slowly. Therefore it is given in a dosage which floods the body on the first day, and the blood level thus secured is maintained by much smaller doses on subsequent days. Thus the patient is given 0.2 gm. (two tablets) of atabrine every 6 hours for 5 doses, and thereafter 0.1 gm. (one tablet) three times daily for 6 days, making a total of 2.8 gm. in 7 days.

Atabrine when first introduced was handicapped by preconceptions established by long custom in the use of quinine. Many were disappointed because it failed to "take hold" as rapidly as quinine, but they were expecting results from a tablet three or four times

² Although the metric system has been officially adopted, many men still "think in grains," and doses still must be expressed in both systems. The dosage of some drugs, such as quinine, is traditionally quoted in grains, and others such as atabrine in grams, a fact which makes the malariologist particularly aware of the present confusion and lack of uniformity.

daily. Atabrine borrows a leaf from the sulfonamides and demands a heavy dose the first day, followed by "maintenance doses."

Used properly in their different ways, either quinine or atabrine will usually stop a malarial attack after one paroxysm and terminate the parasitemia by the end of 1 week.

Many attacks of malaria, however, are ushered in with severe vomiting, and parenteral routes must be used. For intramuscular administration atabrine is greatly to be preferred. The same dosage and time schedule is used, and frequently after two such intragluteal injections the vomiting has stopped and the drug can be continued by mouth. Two-tenths of a gram will quickly dissolve in a few cubic centimeters of saline solution, and the patient tolerates this in the muscle without undue discomfort. Intramuscular quinine is very irritating, and is not well thought of because of the pain and the possibility of chemical abscess.

Patients with the sudden fulminating falciparum infection, or the severe vivax infection which for some reason has failed to receive prompt treatment, are true medical emergencies, and intravenous quinine is conventionally preferred. A high blood level is immediately secured by 10 grains of quinine in 200 cc. of saline. But two things must be remembered. Quinine thus introduced is a depressant, and therefore it must be given very slowly; caffeine, nikethamide, or aminophylline should be at hand. Secondly quinine is rapidly swept out of the blood through the kidneys, and the peak is over within 30 minutes, so the dose should be repeated after 3 hours if the clinical condition has not greatly improved.

Atabrine has also been used intravenously, and it also develops a highly effective blood level which is maintained longer than is that of quinine. But fear of its toxicity has kept it in second place to quinine in the coma or threatened coma of falciparum infections.

Of late, however, large intramuscular doses of atabrine have been advocated as being preferable to intravenous quinine in malarial emergencies. Two-tenths of a gram of atabrine given simultaneously in each buttock will produce a quick upthrust of blood level within 1 hour, and instead of dropping off rapidly as in intravenous quinine, the level will remain as a plateau which can be maintained by subsequent further intramuscular injections or by simultaneous and subsequent oral administration. There are those who believe that this use of atabrine should displace intravenous quinine.

From the standpoint of the patient atabrine is easier to take orally than is quinine. The latter is one of the most bitter sub-

stances known, and the symptoms of cinchonism, the tinnitus and the depression, are universal in therapeutic dosage. The side effects of quinine on the central nervous system and the cranial nerves make it particularly undesirable for aviators. It must be remembered also that quinine seems to have some etiologic relation to the "spontaneous vascular hemolysis" of blackwater fever.

Oral atabrine may sometimes cause nausea, intestinal cramps and even diarrhea, but these symptoms soon vanish if the drug is continued, and they occur almost exclusively in well individuals who are taking small doses. Such effects are seldom seen in the treatment of clinical malaria, even when large doses are being given.

Idiosyncrasy is much more common with quinine than with atabrine. Sudden deafness or blindness which occurs as a result of quinine is not experienced with atabrine. As familiarity with atabrine grows, and as many thousands have been subjected to the conventional dosages, earlier apprehensions regarding mania have been dispelled.

There is no evidence that either quinine or atabrine lose their effect after prolonged administration. Apparently there is no acquired tolerance to either drug. The constancy and universality of their action in man is truly amazing. Parenthetically, however, the clinician must always remember certain very useful adjuvants in the treatment of malaria, such as intravenous saline solution, dextrose, plasma or serum albumin, thiamine, the barbiturates, and lumbar puncture. The chill is fundamentally an allergic phenomenon and its acute discomfort can be relieved by an intravenous injection of calcium gluconate. Incidentally, there is no justification for the use of sulfonamides, mercurials, antimonials, arsenicals, or bismuth in preference to or in conjunction with quinine or atabrine.

SUPPRESSION

It is apparent from the above schedules that the modern treatment of malaria is short and intensive. This is based upon the conviction that the object of treatment is to kill off the circulating parasites. It seems that if this is accomplished the disease will "retire" into its tissue phase for a variable interval of time. There is apparently no advantage in prolonging treatment beyond the disappearance of parasitemia, or in treating the disease during the interval between relapses.

Formerly much longer courses of quinine were given, but it is now believed that such courses, designed as they were to "burn out" the infection, were a waste of drug. If such prolonged

courses had any use, it was to *delay relapse*, and this introduces the topic of suppression.

This is a concept newly emphasized, particularly in military medicine. It recognizes that malaria is fundamentally a disease of the reticulo-endothelial system, and virtually innocuous to the patient so long as it remains there. Symptoms appear only when it spills over from the tissue reservoir into the blood. This can be prevented from occurring by constantly keeping enough drug circulating to kill off the invaders as they appear. A daily tablet (5 grains) of quinine will often do this. Two such tablets (10 grains), taken systematically, will almost certainly stave off relapse. Many people, however, cannot take so much quinine without discomfort, and in addition quinine is too rapidly eliminated.

Atabrine, however, in a dosage of one tablet (0.1 gm.) daily; maintains a steadier effective level. This use of atabrine has now demonstrated its effectiveness in an enormous number of cases. Fears of its long-term toxicity have proved unfounded. Quinine suppression fails to prevent the circulation of gametocytes in about 20 percent of cases, whereas atabrine suppresses them as well as the trophozoites.

Transient parasitemia occurs in many patients under quinine or atabrine suppression, just how frequently is not known; but seldom does this go on to clinical symptoms if the suppression is maintained systematically. If, however, a clinical attack does supervene, a therapeutic course must be given and the suppression resumed. Rightly considered, suppression is an emergency measure, with its greatest sphere of usefulness in military practice. Malaria should be prevented by control of mosquito breeding, and suppression should be discontinued at the earliest militarily feasible moment.

A distinction must be made between suppression and causal prophylaxis. If a causal prophylactic were in existence, it could be given to troops in advance so as to kill off the sporozoites introduced by the mosquito bite. But lacking such a useful agent, suppressive atabrine is given to restrict the disease by preventing the appearance of symptoms and delaying relapse.

MALARIA AT HOME AND ABROAD

Something should be said about the contrast between the freshly acquired malaria of our troops abroad, and the kind of malaria these men have after they get home. The servicemen in the South Pacific, for example, were non-immunes in a hyperendemic area, and the malaria they had there was an extremely serious affair. Both vivax and falciparum malaria, under such conditions, pro-

duce very sick patients. In fact, vivax infections, although called "benign" tertian, may actually cause the patient to feel worse, and the physician more worried, than falciparum. Falciparum, however, is well named "malignant" because of its insidious course and its deceptive tendency to imitate other conditions. The mortality of acute malaria is almost exclusively associated with falciparum infections. Quartan malaria is rare. It may be considered with vivax in this discussion.

In many cases abroad the dosages recommended here are inadequate, and there is a tendency on the part of the medical officer to increase the daily dose, switch from one drug to another, or even use both drugs simultaneously. But evidence accumulates that heroic dosages do not serve their intended purpose. It may be necessary to extend the medication over a longer period than 1 week. It may require 2 or 3 weeks' treatment to clear the parasites from the blood, but the doctor must have faith in his drugs and the patience to pursue the treatment along the conventional line.

If the drug is being taken and being absorbed, 2.8 gm. of atabrine or 240 grains of quinine per week will produce the effective blood levels, and doubling this dose or mixing the drugs is unsound therapy. Of falciparum malaria, it is well to remember that this parasite is particularly susceptible to the antimalarial drugs. A freshly acquired vivax infection is harder to bring under control, but these patients do not die, and if the doctor has patience and remembers the adjuvants at hand, the repeated paroxysms of vivax lose much of their terror.

When these malaria patients reach hospitals in the States, or get back to their own homes, there is a marked change in the situation. Falciparum infection has practically faded out, and the cases are almost entirely of the vivax type. The explanation of this phenomenon is that the falciparum infections have been screened out by time and treatment. The defensive and self-curative power of the body acts rapidly in these cases, and falciparum infections rarely persist as long as 6 months. Furthermore the falciparum parasite's susceptibility to treatment applies not only to therapeutic courses, but also to continued suppression. Evidence accumulates to prove that persistence in atabrine suppressive therapy for 6 weeks or 2 months after departure from an endemic area will entirely prevent subsequent appearance of the falciparum disease.

This is the nearest approach to cure that occurs in the drug treatment of malaria. How atabrine does it is still a question. It may be a true causal prophylactic against falciparum sporozoites,

or it may be lethal to the inapparent tissue phase, or it may hold off clinical symptoms while the body's immunity is rising to effective levels. From a practical standpoint the fact is that returned service personnel seldom have falciparum infections.

This is a fact of great importance to the physician in the United States, and should relieve him of much anxiety. There is one important exception, however; those who have recently returned by air from the hyperendemic zones. These must be suspected of falciparum as well as vivax infection if they fall ill. It is of such cases that Most and Meleney³ warn so convincingly. Two criteria will keep the home doctor from this pitfall; elapsed time, and the uniformity of relapse in vivax. The serviceman who has been away from the malarious zones for several months and who is having a series of relapses can only be suffering from vivax infection. The uniformity of the relapse picture in vivax is as striking as anything in clinical medicine, and relapsing vivax is almost the sole problem in the malaria wards of military hospitals in the United States.

Suppressive atabrine will hold vivax malaria in check, but even if it is continued for some months after departure from a malarious area, 90 percent of vivax cases will relapse sooner or later. The possibility of relapse in vivax infection remains for 3 years or longer. The situation, however, is not so discouraging as it may seem. Many vivax cases cease to relapse long before 3 years, and relapses in general are less frequent and less severe. All that is needed is a promptly instituted therapeutic course of atabrine with each relapse. These patients do not die of malaria; they run no risk of sudden coma or of blackwater fever; and if they are consistently treated with atabrine they do not harbor any gametocytes which might menace their civilian neighbors.

In the malaria of service personnel abroad, attention is chiefly on falciparum infections because of diagnostic difficulties and of their mortality. At home the spotlight is on vivax infections because of their proclivity to persistence and relapse. The conventional dosages as cited should be used in all except certain freshly acquired vivax malaria cases, which may require extension of the course of treatment beyond the conventional 7 days. Clearing of the parasitemia in such cases indicates that therapy may be discontinued shortly thereafter.

QUININE VERSUS ATABRINE

When atabrine was first introduced it was called a "substitute"

³ MOST, H., and MELENEY, H. E.: Falciparum malaria; importance of early diagnosis and adequate treatment. J.A.M.A. 124: 71-76, January 8, 1944.

for quinine, and that word carried the unfortunate connotation that it was a second string to the antimalarial bow, to be used when quinine was unprocurable. The possible impending shortage of quinine recently strengthened this assumption. The primacy of quinine in malaria had been established by long usage, and the natural reaction of each medical officer was to prefer quinine for his own cases. There were rumors of sterility and mania from atabrine, and there was fear of possible intoxication from its long use.

The foregoing discussion, however, has stated the present-day position. In the words of the Surgeon General of the Navy, atabrine when properly used is "as effective as quinine and in many respects to be preferred." A possible severe quinine shortage, which has never actually developed, has nothing to do with the policy of the Army and Navy in advocating the use of atabrine in preference to quinine. The official indications for the use of the older drug have suffered a continuous reduction. The special Board of the National Research Council resolved:⁴

1. That no advantage, and possible disadvantage would accrue to the armed forces were quinine or totaquine to replace quinacrine (atabrine) for the routine suppression and treatment of malaria.

2. That the large-scale production of quinine and totaquine is not now considered a matter of importance for the management of malaria among Army and Navy personnel. . . .

The second statement has immediate bearing upon the recent chemical synthesis of quinine. The lay press, unaware of the significance of recent experience, was inclined to hail the laboratory production of quinine as a sensation, as it would have been perhaps 20 years ago. Malariologists, however, because of the established inferiority of quinine, and because of the difficulty and financial cost of synthesis, are inclined to regard it more in the nature of an interesting "stunt."

In view of the fact that quinine is not essential for any therapeutic purpose, and the fact that atabrine would be preferred even though storehouses were crammed with quinine, what future is there for the older drug? The answer can be only sheer speculation.

There is one field in which quinine may retain pre-eminence; this is among the primitive malaria-ridden peoples of the tropics. It takes intelligence and medical supervision to use atabrine properly, and the goal of atabrine therapy is eventual eradication of the disease. Among primitive peoples suffering with hyperen-

⁴ Medicine and the War: Quinacrine hydrochloride (atabrine) for malaria. Resolution by Board for the Coordination of Malarial Studies, National Research Council. J.A.M.A. 125: 977, August 5, 1944.

demic chronic malaria without benefit of medical service, the object of treatment is mere relief from the temporary exacerbations of the disease. This is the proper place for the inexpensive but effective mixture of cinchona alkaloids known as totaquine. The prompt relief secured by small doses of quinine, and the wide margin of quinine safety in unintelligent hands, may give it a considerable field for a long time to come.

The pharmacologic limitations of both atabrine and quinine are now well-known. It is recognized that what is needed is a drug with comprehensive action against all phases of malaria, the sporozoites, the exo-erythrocytic forms, the trophozoites and the gametocytes. Although there is no such drug at the present, the enormous amount of research now being carried on to this end may suddenly render all previous therapy completely out of date.

Some day the new technics of anopheles control will make the eradication of the vector a practical possibility and thus clear the disease from large geographic areas where it now flourishes. Some day there may be a drug in hand which will attack the disease in its reticulo-endothelial citadel, and lie in wait in the tissues to kill off the sporozoites as they slither down the proboscis of the infected mosquito. When that day comes atabrine and quinine may retire full of honors.



CAUSES OF DEFICIENCY ANEMIAS

Deficiency anemias are caused by a variety of factors: A dietary that is deficient in iron, protein or vitamin B complex; an inadequacy of the gastric juice, which is deficient in either free hydrochloric acid or Castle's enzyme ("intrinsic factor"); chronic intestinal malabsorption, as in chronic diarrhea and sprue; hepatic disease, in which the factor of storage is affected; and multiple pregnancies, in which the developing fetus absorbs an exceptional amount of material from the mother. Single etiologic factors are by no means as important in this regard, however, as multiple causes. Thus a woman on an inadequate intake of iron does not usually develop anemia unless she also has a gastric disturbance (achlorhydria) and either many pregnancies or menorrhagia. And an individual with sprue probably not only has a deficient diet but a chronic intestinal disturbance as well.—DAMESHEK, W.: Hematology. *New England J. Med.* 232: 250-255, March 1, 1945.

EGG ALLERGY

SIGNIFICANCE IN TYPHUS AND YELLOW FEVER IMMUNIZATION

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and

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Immunization of Naval personnel against yellow fever and typhus fever is accomplished by inoculation of material prepared in chick embryo tissue. In the case of yellow fever, the vaccine is a special strain of living virus attenuated through prolonged cultivation in tissue cultures. Typhus vaccine is a suspension of killed typhus rickettsiae cultured by the Cox yolk sac method.

It is apparent that certain individuals who are sensitive to egg protein may have severe reactions to vaccines prepared by these technics. Typhus vaccine contains approximately 10-percent egg white, or 0.6 milligram protein of nitrogen per cubic centimeter, which is a dangerously high amount for an egg-sensitive person. It also contains some yolk and a trace of chick embryo. Yellow fever vaccine contains a larger amount of chick embryo.

Two men, who suffered alarming reactions when receiving their original inoculations, have been studied at the U. S. Naval Hospital, St. Albans. One had been given yellow fever vaccine, and the other, typhus.

CASE REPORTS

Case 1.—A 20-year-old ensign was admitted to the hospital on 25 October 1944 for evaluation because, 5 months before, following his first immunizing dose of yellow fever vaccine, he had developed severe asthma. This attack appeared within 15 minutes and required 5 doses of epinephrine (1 cc. each) over a period of 6 hours for relief. He also suffered from edema of the face and generalized urticaria during the attack.

His past history revealed that since the age of 10 years he had had hay fever in August and September. As an infant he suffered from eczema until the age of 2 years, and from then until 8 years of age he had attacks of asthma. During infancy an attempt was made to desensitize him to an egg allergy by giving him very small amounts by mouth, but he was never able to tolerate more than 30 drops of a solution of 1 ounce of egg albumen in 6 ounces of water. He was also sensitive to various nuts, especially Brazil nuts and coconuts, which caused immediate swelling of the mouth, vomiting, nausea, and asthma.

Skin tests performed shortly prior to admission showed marked reaction to ragweed pollen, egg white, house dust, horse serum, and cottonseed. It was obvious that he was sensitive to both egg white and egg yolk as shown by his inoculation reaction.

Physical examination at the hospital did not show any significant abnormalities, and a chest roentgenogram showed normal heart and lung shadows. Further skin tests showed marked reaction to cow dander, flaxseed, chicken meat, typhus vaccine 1:10, and yellow fever vaccine 1:10. This patient's serum was tested for immunity to yellow fever at the Rockefeller Foundation. The report showed that the serum protected mice against yellow fever and that he had been successfully vaccinated in spite of his severe reaction.

It was the opinion of his civilian physician that his yellow fever inoculation had not in any way protected him or desensitized him against the effects of subsequent injection; with this we concur.

It was considered dangerous to expose him to any further inoculations of material containing egg protein or horse serum, and it was recommended that he be assigned to duty within the continental United States.

Case 2.—A 23-year-old ensign was admitted to the hospital on 21 September 1944. In April 1944 he had received his first inoculation of typhus vaccine. He had received at the same time a typhoid booster shot and 0.5 cc. of tetanus toxoid. Within 2 hours he developed massive generalized edema of the trunk and extremities, dyspnea, coryza, and difficulty in swallowing. Symptoms were relieved by two doses of epinephrine 1:1,000.

His past history showed that he had always been very sensitive to minute quantities of egg, which produced an immediate angioneurotic edema of the lips, mouth, and throat, with swelling of the glands of the neck. He had had an almost fatal reaction to horse serum in tetanus antitoxin in 1935. He had suffered from eczema as a child and from hay fever from the age of 11 to 15 years. His physical examination disclosed no pertinent abnormalities. The following sensitivities were demonstrated:

Material	Clinical history	Skin tests (0.05cc.)
Typhus vaccine.....	Positive.....	Positive (1:10 dilution)
Tetanus toxoid.....	Negative to injection 1943.....	Positive (1:10 dilution)
Yellow fever vaccine.....	Negative to injection 1943.....	Positive (1:10 dilution)
Egg white.....	Positive.....	Positive (0.001 mg/N)
Horse serum.....	Positive.....	Positive (1:100 dilution)
Triple typhoid vaccine.....	Negative.....	Negative

It was decided that the dangers inherent in unlimited Naval service in this case were similar to those in the previous instance, and duty within the continental United States was advised with the recommendation that no more horse serum or vaccines of this nature be administered.

COMMENT

Two methods of overcoming this problem present themselves; namely, (1) alteration of the vaccine by the use of preparations not containing chick embryo tissue, egg white, or egg yolk products, and (2) desensitizing known reactors.

Use of vaccine free from egg protein.—At present there is no

method practical for the production of yellow fever vaccine except through the use of the attenuated virus grown in the chick embryo tissue. So far as typhus fever vaccine is concerned we have been informed that, while the Germans and Russians have used the mouse-lung preparation, apparently there is not sufficient material in this country for active immunization. It is also reported¹ that the mouse and rat lung technic of Castaneda was used with murine and endemic strains and that the cross immunization to epidemic typhus was probably not sufficient for protection. Work on the use of duck and turkey eggs is in an experimental stage,² but the yield of vaccine from duck and turkey eggs is five times that of the yield from hens' eggs. The residual proteins are, therefore, correspondingly diluted in the preparation of a comparable dose of vaccine. While the specificity of protein reactions might make material from this source safe to use in such cases, it is of no practical value at present.

Desensitization of the patient.—The procedure of desensitization of the allergic reactor in such cases appears impractical because of the prolonged course of injections necessary and the need to maintain this state by monthly inoculations.

CONCLUSIONS

Extremely sensitive, allergic, egg reactors constitute a numerically small but very important group of Naval personnel, who may develop serious, and possibly fatal, allergic reactions if inoculated with the vaccines of yellow fever and typhus which are cultivated in chick embryo or yolk sac tissue. All efforts should be made to discover such persons prior to inoculation, and each person should be asked if he is sensitive to egg before being given typhus or yellow fever vaccine. Persons with an egg-sensitivity history should be skin tested with diluted egg white and egg yolk. If they show negative skin tests to 1:10 dilution, it is believed that the vaccine can be given safely. The knowledge of severe immediate reactions to ingested egg ever since childhood was a prominent feature in the histories of the two patients here reported and should have been admitted by them prior to appointment.

Such individuals should not be admitted to the Service because of the potential danger to themselves through immunizing injections, and also because this sensitivity is often only one manifes-

¹ Personal communication from C. E. Roach, M.D., Eli Lilly and Company, Indianapolis.

² BERKOWITZ, A. P.: Notes on use of duck and turkey eggs for large-scale preparation of epidemic typhus vaccine. S. African J. M. Sc. 9: 109-110, August 1944.

tation of a generalized allergic state. If the sensitivity is discovered after enlistment or appointment, it would appear wise not to submit them to inoculation of vaccines containing chick embryo products and to classify them as not qualified for overseas duty.

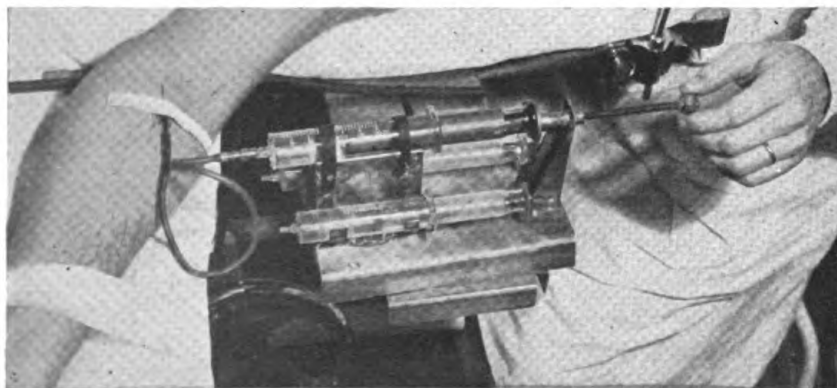
ADDENDUM.—Through the courtesy of Major Arthur Stull, Sanitary Corps, U. S. A., we have received information that thirteen anaphylactic reactions, following the use of an egg vaccine, have come to the attention of the Preventive Medicine Service. One death occurred after inoculation for cholera and typhus given at the same time. According to this information "it is believed that egg-sensitivity diagnosed by a reliable history or adequate skin tests is a condition warranting special consideration in assignment." For a review of the experimental work done in this field, reference is invited to a joint investigation initiated by the Division of Virus and Rickettsial Diseases, Army Medical School, Washington, D. C.—"Allergenic and Anaphylactogenic Properties of Vaccines Prepared from Embryonic Tissues of Developing Chicks."



DEVICE FOR INTRAVENOUS ANESTHESIA

A device constructed primarily to hold a syringe rigidly in place, enabling the anesthetist to exert finger-tip control of the solution being given and at the same time to observe and care for the patient is shown in the accompanying illustration.

It consists of a metal base and a turntable which can be constructed by the ship's force from materials found on board.



The base has cutouts on each side which permit attachment to the runners on each side of the operating table. The turntable is secured by a set screw in a slot cut lengthwise in the base and may be moved back and forth or rotated as desired. The turntable is fitted with a cradle for holding a 20-cc. syringe, secured by rubber strips, and has clips on both sides for additional filled syringes. The plunger is controlled by set screws.—**GATELEY, J. R.**, Lieutenant Commander (MC) U.S.N.R., and **HELGESON, C. M.**, Lieutenant, junior grade (HC) U.S.N.R.

SIMPLE LOCAL TREATMENT FOR THROAT INFECTIONS

HARRY H. ROSENTHAL

Lieutenant Commander (MC) U.S.N.R.

Two formulas for local treatment of severe throat infections by lozenges, which utilize minimal medication with maximal effect, have been evolved at this dispensary. The results obtained are so strikingly effective that it is believed wide utilization of the formulas would mark a distinct advance in throat therapy. The penicillin lozenge medication elicits a response superior to that obtainable with a triple dose of penicillin by injection.

A gelatinous throat lozenge has given remarkable results in cases of follicular tonsillitis and ulcerous Vincent's angina. The patient is admonished to permit the lozenge to dissolve slowly on the tongue. The medication goes into solution in approximately 15 minutes, during which time the lesions are constantly bathed in a buffered solution of penicillin (2,500 units). One lozenge is administered hourly. The following events occur in sequence: (1) There is dramatic relief of pain on deglutition within 4 hours; (2) tonsillar edema and necrotic tissue are reduced as much as 25 to 50 percent within 12 hours; (3) toxic appearance and fever usually vanish within from 24 to 36 hours.

In the cases of Vincent's angina seen here, short chain streptococci, in addition to *Borrelia vincentii* and fusiform bacilli, invariably have been found in the tonsillar tissue. It would appear that the severity of the symptoms is dependent upon the streptococci. In addition to the lozenge treatment, diluted peroxide gargles are administered three times daily to wash away necrotic material and for possible effect on the saprophytes.

The throat lozenge is made according to the following formula:

	<i>Gm. or cc.</i>
Sodium citrate	2.0
Starch	20.0
Gelatin	40.0
Sucrose	60.0
Distilled water	140.0
Penicillin, calcium	20.0 (100,000 units)
Oil of peppermint.....	6 minims.

The solids and the distilled water are boiled together for 3 minutes under constant stirring. The mixture is cooled to approximately 80° F., and the penicillin added while stirring constantly. The mixture is then poured into a

small waxed container, 8 by 16 by 2 cm., covered and kept in the refrigerator. (A standard wooden slide-container box, well waxed on the inside, is used here as a form.) The gel is readily divisible into 40 pleasant-tasting cubes, enough for a 2-day treatment.

A chewing wafer of sulfonamide mixture which has given excellent results is used in cases of severe pharyngitis and mild forms of tonsillitis. The wafer has the following composition:

	<i>Gm. or cc.</i>
Sulfanilamide	2.0
Sodium bicarbonate	2.0
Sulfathiazole	4.0
Paraffin wax	16.0
Oil of peppermint.....	10 minims.

The solids are made into a fine powder, and under constant stirring are added to the melted wax and peppermint, poured into a mold and divided into 20 tablets.

The patient chews the substance as he would gum. One tablet is administered every 2 hours. Subjectively there is an almost immediate soothing effect on the inflamed mucous membranes. Resolution of the inflammatory process usually occurs in 2 or 3 days.



TREATMENT OF LOW BACK PAIN

The pathogenesis of the low back complex (lumbago, sciatica, protruding disk) is explained on the ground of a primary lumbar kyphosis, a straight lumbar spine preceding all signs and symptoms. The reverse of lumbar lordosis is caused by stooping and sitting occupations. Among the signs accompanying the disappearance of lumbar lordosis attention is called to the spasm of the lateral abdominal muscles and to the lumbar shift of the dorsal kyphosis. In more than 60 cases complete relief from the local and nervous symptoms could be obtained by putting the patient in a bed, the front legs of which were elevated from 12 to 20 inches for from 7 to 14 days. Recurrences were rare and easily handled by the same method. In patients with severe nervous symptoms a short plaster jacket was applied in hyperextension for another two weeks. All patients returned to their former occupations.—FARKAS, A., and EASLEY, G. W.: Quick and simple treatment of low back pain based on new conception of its genesis. *West Virginia M. J.* 41: 103-107, April 1945.

WARNINGS IN USE OF PENICILLIN

NICHOLAS S. SCARCELLO

Lieutenant Commander (MC) U.S.N.R.

After one year's experience with penicillin some important observations have been made on dangers to guard against in its use. Although some of them have been mentioned in recent literature, their importance has not been thoroughly emphasized and made common knowledge.

Like many others I have reported on the drug's miraculous results, especially in the so-called sulfonamide-resistant gonorrhea cases, recording 100-percent cures in a review of 200 cases. To the present in some 4,000 cases in the Navy, 96 percent have been reported cured. However these cases could not be followed up because of the exigencies of the war, and penicillin has been used chiefly in the armed forces.

In reviewing 100 consecutive admissions for gonorrhea in the last 6 months, it was found that 22 patients had received penicillin prior to admission to the hospital. They all had either a persistent discharge, varying from a "morning tear" to a profuse discharge, or a positive prostatic smear. Twelve of these patients had been discharged well. These recurrences and failures to respond to penicillin are definitely on the increase so that the present percentage of cures will eventually be proved much smaller.

One reason for these failures is that penicillin is being administered with little thought as to the optimum dosage, or of what is to be expected of the drug. It is given as a routine procedure in the belief that if the first course of penicillin does not produce a cure, it should be followed by a second, third, or fourth. Most cases which fail to respond to the optimum dosage usually will not respond to added doses. Although there are patients who will require more than one course, sufficient time should be allowed to elapse before following the first with another course. It should be kept in mind that in the treatment of gonorrhea it is not unusual for a discharge to require 3 or 4 days after cessation of penicillin treatment before clearing up.

Another cause for the continued "morning tear" is the constant and frequent stripping to which most patients subject themselves. They become so conscious of their urethra and its condition that it is not unusual for them to strip it at each voiding, and before and after bedtime, and usually with enough force and enthusiasm

to cause what might be termed a "traumatic urethritis." In one ward in this hospital more than 50 percent of the patients had a persistent urethral morning discharge of several weeks' duration despite therapy and negative laboratory reports. All these patients were able to return to duty within 2 weeks when stripping was limited. Stripping the urethra should be done only at sick call, and then with care.

Another cause for prolonged discharge is that patients are not being restricted for long enough periods following the administration of penicillin to allow the local urethritis to heal fully.

A serious danger in the use of penicillin is the false hope caused by recent reports that this was the long-sought drug which would completely eradicate gonorrhea. Prior to the advent of penicillin, the general public had a respectful fear of this infection, which was increased by the difficulty and time involved in obtaining a cure. However penicillin has partly removed this fear because of the ease and short time required to obtain a clinical cure. It is often a lay opinion, moreover, that but five shots are required for a quick, sure cure. This false impression has caused some neglect of prophylactic measures used previously and will therefore lead to an increase in the incidence of gonorrhea.

The greatest danger lies in the treatment of those patients who may have contracted syphilis at the same exposure. If 100,000 units of penicillin, which is generally accepted as the optimum dose for the treatment of gonorrhea, does not at the same time cure syphilis in its incipient stage, then we are in for a great awakening 3 to 5 years from now, if not much earlier.

There is no question at present that this amount of penicillin will heal a primary sore, but does it cure syphilis as well? If not, what does it do; will it eliminate the first stage of syphilis; will syphilis lie dormant for a period and then flare up; or will it appear in its second or third stage? It seems that much more clinical experimentation is necessary and more time must elapse before these questions can be answered.

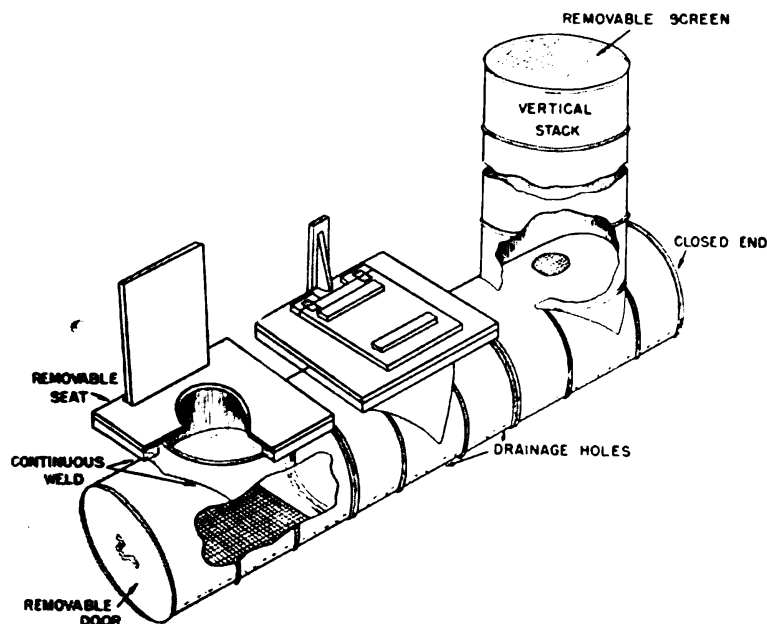
It would seem best to treat all gonorrhea patients with the sulfonamides and obtain the 65- to 70-percent initial cures, and then treat the remaining ones (when they have become sulfonamide-resistant) with penicillin. In this way enough time will have elapsed for a chancre to appear. In the end the same number of cures would be obtained and all that would be lost would be 2 weeks' time. If this procedure is not practical, then all patients who are given penicillin, and also all those who have already received penicillin, should have a blood test made within 3 months and rechecked at 6, 12 and 24 months.

These are real dangers which we are facing in the use of penicillin, especially in the venereal diseases. Until other means of eliminating them are discovered, they should always be kept in mind in the interest of the patient's future health.



NEW INCINERATOR HEAD

A new type of head for field use is constructed of oil drums, functioning as an incinerator, and disposing completely of all wastes by burning. This head has proved more sanitary than the usual pit-type latrine; fly breeding is impossible and there is very little odor to attract flies. Maintenance of the head is accomplished by daily or triweekly burning with Diesel fuel oil, depending on the amount of use to which it is subjected.



A screen gate is provided beneath each seat, which keeps fecal matter about 6 inches above the bottom of the horizontal drum, so that proper combustion can take place. Liquid wastes escape into the surrounding sand on which the head is erected and cause no odor. Holes are provided in the bottom of the horizontal drums for this drainage.—GREGORY, J. G., Chief Carpenter (CEC) U.S.N.R., and COHEN, H. M., Lieutenant (MC) U.S.N.R.

LEUKOCYTE COUNTS IN WHITE AND NEGRO RECRUITS ON SULFADIAZINE PROPHYLAXIS¹

A COMPARATIVE STUDY

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and

ABRAHAM M. WECKSTEIN

Ensign H(S) U.S.N.R.

During the course of a sulfadiazine prophylaxis program for streptococcus infections at a Naval training center, a sampling of leukocyte counts was done by Epidemiology Unit No. 13 on 650 white and 250 Negro recruits who had been taking 1 gm. of sulfadiazine prophylactically daily for at least 3 weeks. The results of the blood sampling appear in table 1.

TABLE 1.—*Leukocyte counts in white and Negro recruits receiving prophylactic sulfadiazine*

	Whites	Negroes
Total number of counts.....	650	250
Average (mean) cells per cu. mm. of blood.....	8,064	7,138
Percent above 10,000.....	13.1	9.2
Percent between 5,000 and 10,000.....	82.9	79.2
Percent below 5,000.....	4.0	11.6
Percent below 4,000.....	0.15	0.8

Two Negro recruits and one white recruit were found to have a leukocyte count below 4,000, and their counts were immediately rechecked. In all three cases, the suppression occurred mainly in the granulocytic series. These differential counts are shown in table 2.

Each of the three men with counts below 4,000 was immediately withdrawn from the sulfadiazine prophylaxis program. After 3 days, one of these men attained a normal count; after 7 days the second had a normal count; and there is no information on the third person since he left the station immediately after the discovery of the leukopenia.

The results of this sampling indicated that the mean leukocyte counts of both whites and Negroes fall within the normal hemato-

¹ From the laboratories of U. S. Navy Epidemiology Unit No. 13 with the technical assistance of Jo A. Robar, Pharmacist's Mate, first class, U.S.N.R.; Thomas C. Kessler, Pharmacist's Mate, second class, U.S.N.R.; and Martin G. Austin, Pharmacist's Mate, second class, U.S.N.R.

TABLE 2.—*Absolute values per cu. mm. of blood*

Blood cells	Case A (Negro)	Case B (Negro)	Case C (White)
Neutrophils	1,073	891	1,943
Basophils	0	46	0
Eosinophils	28	0	67
Lymphocytes	1,415	891	1,139
Monocytes	311	460	201
Totals	2,827	2,288	3,350

logic standard of 5,000 to 10,000 per cu. mm. of blood. However it is noted that the mean average count of the Negro recruit is lower than that of the white recruit and that approximately 7 per cent more of the Negroes had counts below five thousand.

It is known that the sulfonamide drugs, having the benzene ring as their central structure, have been responsible for cases of leukocytic depression. The question arises whether these differences observed in the sulfadiazine prophylaxis program between the leukocyte counts of whites and Negroes are racial, as previous studies appear to indicate, or rather a greater sensitivity on the part of the Negro to the leukocyte-suppressing action of sulfadiazine. In an effort to answer this question, leukocyte counts were taken on a random sample of 125 Negroes on first reporting at the training center for duty before receiving sulfadiazine. These Negroes had a wide distribution in respect to age (range from 17 to 36 years), degree of racial mixture, home state, and occupation. The results of these counts appear in table 3.

TABLE 3.—*Leukocyte counts in Negro recruits not under sulfadiazine prophylaxis*

Total number of counts	125.
Average (mean)	6,940.
Percent above 10,000	1.6
Percent between 5,000 and 10,000	86.6
Percent between 4,000 and 5,000	8.0
Percent below 4,000	0.8

Comparing the leukocyte counts in the Negroes taking sulfadiazine prophylaxis and those not taking the drug, no great difference in the mean counts is revealed; however 3.6 percent more of the former had counts below 5,000 cells per cubic millimeter of blood, and 10.4 percent more of the latter fall within the normal hematologic range.

It is well known that many factors are concerned in regulating the leukocyte count in normal persons. For this reason a wide range has been adopted as a normal hematologic standard for leukocytes. Studies by Kracke (1) in healthy students have shown that the leukocytes average about 8,000 per cubic millimeter.

Lewis (2) reported that there is often a leukopenia of 6,000 and as low as 4,000 in normal Negroes. Sturgis and Bethell (3) showed that the average leukocyte count of 23 Negroes was 4,050, and of 7 whites was 7,600. These 30 individuals had similar diets and lived under essentially similar conditions. Forbes, Johnson and Consolazio (4) examined Negro and white sharecroppers in Mississippi who lived under the same conditions of diet and environment and reported that the average count in all pure-bred Negroes was less than 6,200 with a majority below 4,000. The white subjects living on the same diet had an average count of 7,600.

CONCLUSIONS

In the group observed, the average leukocyte count of Negroes, whether taking sulfadiazine prophylactically or not, was lower than the average leukocyte count of white recruits at a Naval training center (age range from 17 to 36 years). Sulfadiazine appeared to have a greater suppressive action on the leukocytes of Negro recruits than on white recruits.

The comparison of leukocyte counts in Negro recruits taking sulfadiazine prophylactically and those not taking the drug reveals that more of those on prophylaxis have counts below 5,000, whereas more of those not on prophylaxis fall within the normal hematologic range.

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WAR WOUND INFECTIONS

BATTLE CASUALTIES FROM THE SAIPAN CAMPAIGN
WITH SPECIAL REFERENCE TO INFECTIONS
DUE TO CLOSTRIDIA

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The present war has been characterized medically by the statistically low incidence of wound infections, especially those due to organisms belonging to the spore-bearing family. Among the reasons for this low incidence of infection might be listed: (1) The short interval between injury and medical care of wounds; (2) judicious use of drugs of the sulfonamide group; (3) use of supportive therapy, such as plasma; (4) early use of penicillin in large amounts; (5) the prophylactic use of tetanus toxoid; and (6) the relatively low incidence of organisms of the clostridium group in areas where injuries have occurred.

Spore-bearing organisms are known to exist aboard ships, and cultures of these organisms are occasionally found to include members of the tetanus and gas-forming group. This is particularly true of those taken from approaches leading to the heads. Occasionally these organisms may also be cultured from elsewhere on ships. Infections caused by these organisms have been rare and of little consequence numerically in Naval battle casualties. Moreover in land fighting for the first months of the war there was a low incidence of clostridial infections.

With the return of the Saipan casualties to this hospital, however, the first relatively large group of wounds infected with spore-bearing organisms indicative of fecal contamination was seen. The reasons for this are apparent. Saipan was the first major encounter in an area where agriculture was carried on in any appreciable degree. Moreover it is known that "night soil" has been used for fertilization in this area for a considerable time by the Japanese, bringing with it greater danger of infection from the soil. In addition hygienic conditions among the Japanese generally were primitive.

Since the time of receiving Saipan casualties, 36 positive cultures of the clostridium group were demonstrated. In addition there were three instances of gas bacillus infection in the tissues of amputated extremities, making a total of 39 gas bacillus or tetanus infections in this group.

The following classification of the family bacillaceae was used. Some aerobic members of this family were seen in several patients. These caused no difficulty in cultural studies and were easily identified.

Rods producing endospores, usually gram-positive. They often decompose protein media actively through action of enzymes.

Key to the genera of family bacillaceae:

1. Aerobic forms, mostly saprophytes.

Genus I. *Bacillus*.

2. Anaerobic forms (occasionally microaerophilic) ; often parasitic.

Genus II. *Clostridium*.

The important organisms found in war wounds are divided broadly into two groups according to their ability to ferment carbohydrates or digest proteins. This distinction is not clear-cut, as some of the saccharolytic organisms also have a slight proteolytic action.

Saccharolytic anaerobes which ferment carbohydrates vigorously with production of acid and gas are:

Cl. perfringens
Cl. septicum
Cl. chauvoei
Cl. oedematiens
Cl. fallax
Cl. tertium

The more important proteolytic anaerobes that digest protein material with the formation of various amino-acids and sulfur compounds which blacken the cultures are *Cl. sporogenes* and *Cl. histolyticum*.

ORGANISMS RECOVERED

<i>Cl. perfringens</i>	7
<i>Cl. tetani</i>	2
<i>Cl. sporogenes</i>	8
<i>Cl. fallax</i>	2
<i>Cl. septicum</i>	1
Mixed	16
Gas infection on histologic but not cultural basis...	3

The following six classification groups show the cultural characteristics of the principal organisms of each group found in the patients under study.

***Clostridium perfringens* (Cl. welchii)**

Rods: Thick, 1 to 1.5 by 4 to 8 microns, occurring singly or in pairs, less frequently in short chains.

Nonmotile; spores oval, central to eccentric, not swelling the rods. Encapsulated, gram-positive.

Anaerobic. Distinctive characteristic: Stormy fermentation of milk.

Found in: Exudate of gaseous gangrene.

Habitat: Widely distributed in feces, milk, sewage, and soil.

***Clostridium sporogenes* (B. sporogenes)**

Rods: 0.6 to 0.8 by 3 to 7 microns with rounded ends, occurring singly, in pairs, or less frequently in short to long chains and filaments. Motile with peritrichous flagella. Spores oval, eccentric to subterminal, swelling the rods. Gram-positive.

Gelatin: Liquefied and blackened.

Blood agar: Hemolyzed.

Litmus milk: Softly coagulated. Litmus reduced. Slow peptonization, leaving dark amber colored liquid.

Found in: Intestinal contents and exudate of gaseous gangrene.

Habitat: Common in soil, especially where heavily manured.

***Clostridium septicum* (Cl. septicum; Vibrion septicum)**

Rods: 0.6 to 0.8 by 3 to 8 microns, rounded ends, occurring singly, in pairs, and in short chains in cultures; long chains and filaments commonly predominate in body exudates. Motile with peritrichous flagella. Spores oval, eccentric to subterminal, swelling rods. Gram-positive.

Gelatin: Not liquefied.

Litmus milk: Acid and coagulated. Clot channeled by gas but not digested.

Blood serum not liquefied.

Found in: Ward wounds, appendicitis.

Habitat: Not determined.

***Clostridium tetani* (B. tetanus)**

Rods: 0.4 to 0.6 by 4 to 8 microns, rounded ends, occurring singly, in pairs, and often in long chains and filaments. Motile with peritrichous flagella. Spores spherical, terminal, swelling the rods. Gram-positive.

Blood agar: Hemolyzed.

Litmus milk: Slow precipitation of casein, or soft clotting, but no definite digestion.

Gelatin: Slowly liquefied and blackened.

Found in: Wounds, soil, and feces.

Habitat: Soil, human and horse intestines and feces.

LOCATION OF INJURIES

Upper extremity	5
Lower extremity	12
Multiple extremities	10
Brain	2
Chest	8
Abdomen	2

As a rule these cultures were mixed and were seldom found in pure form. In 16 instances the cultures showed a growth of more than one member of the clostridia, frequently three or more. Aerobic members of the bacillaceae family were not uncommon. Of other organisms, *Escherichia coli* and *Bacillus proteus* were the most common and were often found together with staphylococci. In wounds of the chest, *Staphylococcus aureus* and *Pseudomonas aeruginosa* were the rule in addition to the clostridia.

The two patients suffering from tetanus infections received adequate doses of tetanus antitoxin after arrival at this hospital. They had also been given tetanus toxoid after receiving their injuries. Their course has been satisfactory.

The majority of patients suffering from gas infections received penicillin. The majority of cultures from wounds became sterile for clostridia after an average of 7 days of therapy with penicillin. A certain percentage, not as yet determined, are transitory in this regard, and showed anaerobic growth after a latent period of several days, when the patients would again have symptoms of bacterial activity and increased sepsis. This may be explained on the grounds that the organism is attenuated by therapy, and like all bacillaceae, becomes activated under more optimal environmental conditions. In most instances, however, cultures remained sterile after once reaching that stage. As a matter of fact, clostridia would clear faster than many of the contaminants. In chest wounds particularly, *Staph. aureus* and *Ps. aeruginosa* persisted longer than did the anaerobes.

Tissue studies were made on the infected areas in all extremities which required amputation. A notable feature was the relative lack of gas infiltration and replacement in the soft tissues infected with gas-forming organisms. This was particularly apparent in those patients who had received adequate doses of penicillin. Only four patients had received gas bacillus antitoxin in addition to the penicillin, and this agent seemed to have little additional advantage, if any, over penicillin alone.

Ten amputations were performed in this group. The majority of these were necessitated by extensive compound fractures rather than by the gas bacillus infection.

It is difficult to estimate the incubation period of these infections. The impression gained from questioning the patients and reviewing the records showed that in most instances signs of infection became apparent in from 3 to 7 days after injury. Whether this was due to nonspecific organisms such as staphylococci or streptococci or actually due to clostridia cannot be determined definitely from the data now available. Without exception,

however, the patients presented cultural evidence of clostridia on entry to this hospital. The time interval between injury and entry into this hospital varied from 3 days to 1 month, and because of this, incubation periods must be estimated.

The question may be raised: Are we dealing with new variants of known clostridia in these patients, or are they so attenuated by the use of penicillin that they respond in a manner hitherto unknown. It would seem that the latter is probably nearer the correct explanation, and the observation first clinically demonstrated by McKnight and his associates,¹ that gas bacillus infections are favorably affected by penicillin, promises to open up a wide avenue of clinical research. Much work needs to be done to see if all members of the clostridia group are affected by this therapeutic agent, and if so, the elaborate classification of the family may eventually be placed in the categorical position of being principally of academic interest only.

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EPITHELIOMA OF PALATE FROM SMOKING

Cancer of the palate is common in the Northern Circars, India. An inquiry into the incidence showed that there was a peculiar type of smoking with the lighted end of the cigar inside the mouth. This habit usually starts at a young age. Children of 6 and 7 years begin to acquire the habit and continue it throughout their lives. No satisfactory explanation could be obtained for this smoking habit. Some merely stated that it was a habit with them, and it gave them comfort while working. Cancer of this type usually begins to manifest itself after the age of 30, the average age being 42.5 years. The oldest in the series was 60 years. As a result of the irritation produced by the heat, changes occur in the epithelial lining of the palate, this undergoing leukoplakic changes at the site where the lighted end lies in juxtaposition.

Medical advice is sought when one of the patches bleeds or smart while the persons is eating curried food. Sometimes, either due to burns or irritation, these patches develop ulcers which vary in shape and size, and undergo a malignant change, and when they do so they are either of the nodular type or of the ulcerative type.

On histopathologic examination, they have proved to be true epitheliomas of the squamous type. The secondaries usually spread to the lymphatic glands in the submaxillary area and later to the upper anterior superficial and deeper cervical groups of glands.—KINI, M. G.: Epitheliomas of palate caused by smoking of cigars with lighted end inside mouth. Indian M. Gaz. 79: 572-574, December 1944.



ANTITRYPSINS AND STREPTOFIBRINOLYSIN

Two antitrypsins are available, the crystalline "trypsin inhibitor" isolated from beef pancreas and the soybean antitrypsin. Both were tested for their effects on in vitro liquefaction of human fibrin by beta hemolytic streptococci filtrates. It was found that as little as 1 mg. of the pancreatic inhibitor would delay liquefaction of solid fibrin from the control period of 39 minutes to as much as 3.5 hours, and that 5 mg. would delay fibrinolysis for as long as 63 hours. This inhibitor not only neutralizes streptofibrinolysin, but in higher concentration inhibits aseptic autolysis of human fibrin. The pancreatic inhibitor retards the rate of proliferation of hemolytic streptococci and the soybean inhibitor has similar properties but somewhat less effective, 5 mg. delaying fibrinolysin for but little more than 24 hours. Both pancreatic and soybean antitrypsins are nontoxic when injected in relatively large doses into the peritoneal cavity of mice or guinea pigs.—MANWARING, W. H.: Antifibrinolytic therapy. *California & West. Med.* 62: 53-54, February 1945.



TREATMENT OF FUNGUS INFECTION OF SKIN

The great variety of methods of treatment used by medical officers afloat is evidence that a satisfactory agent is yet to be found for the treatment of fungus infection of the skin among Naval personnel in tropical climates. Agents which work satisfactorily in temperate climates fail to improve the condition and may even make it worse. Inquiry at every opportunity of medical officers from other ships regarding the routine treatment for fungus infections brought out the following agents: Salicylic acid in alcohol, tincture merthiolate, Castellani's paint, salicylic ointment, Whitfield's ointment, calamine lotion, potassium permanganate, gentian violet, sulfonamide ointments, soaks and packs of boric acid, and magnesium sulfate solution.

Iodine, 3½ percent, which has been used by dermatologists for some time, seems to have little or no effect on the lesions. Fungus infections of the skin may not rank high in the causes of disability, but certainly produce much discomfort and loss of manpower; from 70 to 80 percent of those attending sick call report for treatment of fungus infections. A more specific treatment for fungus infections is hopefully awaited.—JOHNSON, W. R., Lieutenant (MC) U.S.N.R.

MYOCARDIAL INFARCTION—ROENTGEN DIAGNOSIS

LEO H. GARLAND

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The clinical diagnosis of infarction secondary to coronary narrowing or occlusion is now reasonably reliable in the majority of instances, especially when confirmed by such findings as definite electrocardiographic changes, slight fever, leukocytosis, and an increased sedimentation rate (1). However there are some cases in which the clinical diagnosis is in doubt and in which additional data are desirable or even essential. Such cases include those with (a) an indefinite or atypical history, with or without positive electrocardiographic findings, (b) a definite history but negative or inconclusive electrocardiographic findings, and (c) no definite history but positive electrocardiographic findings.

It has been estimated that about 15 percent of patients with clinical and necropsy findings of coronary occlusion have negative electrocardiographic findings, at least in the early weeks following development of the lesion (2). It is in this group particularly that additional data are desirable.

Roentgen-ray examination of the heart for the determination of myocardial damage includes fluoroscopy and roentgenography and in some instances roentgenkymography. The fluoroscopic detection of severe myocardial damage is not difficult, but is prone to the limitations of subjective impression and provides no record which may be subsequently reviewed or studied by others. In brief the silhouette is studied as to size, shape, position and motion. Areas of myocardial damage are suggested by localized abnormalities of curvature and motion (flattening and diminished excursion of the ventricular wall or, less commonly, bulging and paradoxical expansion).

The criteria for the fluoroscopic diagnosis of heart disease have been adequately described. In passing it may be observed that I cannot agree with Master, Dack, and Jaffe (3) who stated that the fluoroscopic diagnosis of coronary occlusion is so simple that hospital corpsmen may perform it with just a little training.

Standard roentgenographic examination includes a postero-anterior film at 6-feet target-film distance, plus such other views (oblique or lateral), as the examiner may deem advisable. In the presence of pulmonary congestion or pleural changes it is often

necessary to utilize barium cream in the esophagus in order to outline the posterior margins of the cardiovascular shadow. For the determination of cardiac enlargement Ungerleider's table on transverse cardiac diameters based on body height and weight may be used. Although enlargement can be detected reliably only if comparable films are available prior and subsequent to the development of such change, a reasonable estimate of enlargement can be made in the majority of patients by use of this table. The shape of the heart may give a clue to the presence of an area of myocardial damage by localized abnormality of curvature (slight flattening of the normal ventricular convexity; occasionally bulging or actual cardiac aneurysm).

Cardiac kymography is usually performed with the multiple slit kymograph, using a 12:1 grid ratio. Films are made in whatever projection is believed most liable to demonstrate the involved area of myocardium, usually in the postero-anterior and sometimes the left anterior oblique positions. Technical factors vary with the patient's build and pulse rate. Most cases are satisfactorily handled with these factors: 85 kv., 100 ma., 48-inch target-film distance, $1\frac{1}{2}$ seconds time, deep inspiration. In questionable cases the film may be repeated, perhaps in a different phase of respiration, or with the slits turned to an angle other than the horizontal. Frames with diminished, absent, or paradoxical ventricular waves may be indicative of myocardial disease.

ROENTGENKYMOGRAPHY

Roentgenkymography is a method for recording the movements of an organ on an x-ray film. There are several possible methods, but only multiple slit kymography will be discussed. Multiple slit kymograms are records of one component of the movement of the organ under survey, the only motion accurately registered being that which occurs in a direction parallel to the slits. By turning the slits to various angles the motion of different portions of the organ may be recorded.

For purposes of myocardial wall study, horizontal slit kymograms are usually adequate, since the majority of infarcts occur in those portions of the ventricles which are near the anterior interventricular groove. Even when they are not located near the left cardiac border, infarcts tend to cause variable degrees of "splinting," with restricted or irregular contractions of the left border. Such abnormal contractions are usually detectable in routine postero-anterior kymograms.

The individual kymographic waves are examined as to amplitude, shape and time-phase. The amplitude and shape of ven-

tricular waves normally show wide variations, and therefore apparent alterations must be critically evaluated. This applies especially to waves near the apex where, owing to occasional predominance of vertical over horizontal contractions, motion may seem to be absent. Time-phase is best studied with the aid of calipers. The peak of a diastole or the valley of a systole may be measured from the base of the frame under review and that distance compared with other frames over the ventricular outline. Since the visible evidence of ventricular systole appears first at the base and progresses downward to the apex, the timing or phase of ventricular waves varies a very slight amount over the ventricular border.

If serial films are made for comparison, it is essential that they be made in identical phases of respiration, with similar time exposures and with smoothly moving films, since the shape and amplitude of the waves are profoundly influenced by these factors.

The amplitude is diminished in myocardial disease (including infarction, marked enlargement, hypothyroidism, thiamine deficiency, severe infections and cardiac neoplasm), and in certain pericardial disorders (effusion and adherent scars). A negative kymogram does not exclude the presence of an infarct. The most reliable positive kymographic sign of infarction is the presence of either paradoxical motion or an immobile area between two zones of normal motion. The most common signs are systolic expansion or absence of motion over the lower half of the left ventricular border. When this is limited to the apex, it should be confirmed by films made during expiration or taken on succeeding days. Restricted movement at the apex alone may be due to physiologic variation in the direction of contractions.

It is to be noted that the area of abnormality does not necessarily coincide with the postmortem location of the infarct. Dack and his coworkers (4) suggest the following possible anatomic explanation for this: "The superficial muscle layers are attached to the auriculoventricular ring posteriorly, and wind around the left ventricular margin and apex to the anterior surface, where they are inserted in the papillary muscles. It is possible to speculate that infarction or scarring posteriorly will deprive the spirally arranged muscles of their posterior fulcrum, and therefore the portion of the muscle in the apical region or along the left ventricular contour gives way with each systole of the heart, and passively expands or remains stationary instead of contracting."

A "positive" kymogram may be found in patients with no clinical symptoms of myocardial infarction. This may be due to the presence of a silent or asymptomatic infarct, or occasionally to

unexplained physiologic variations in cardiac movements. Myocardial tumors and localized adherent pericardial scars may cause similar changes.

The differentiation of extensive infarction from diffuse myofibrosis or muscle infiltration may be impossible on kymographic evidence alone. Generalized diminution of contractions and other changes may occur in all these conditions. However localized infarction will usually show localized alterations (especially systolic expansion) which are relatively characteristic.

Areas of infarction have been followed for periods of several months and seem to return to normal pulsations in some cases, which is plausible in view of wide clinicopathologic opinion that about 25 percent of infarcts heal completely. Sussman and his associates (5) reported such change in 17 percent of patients followed for 2 years.

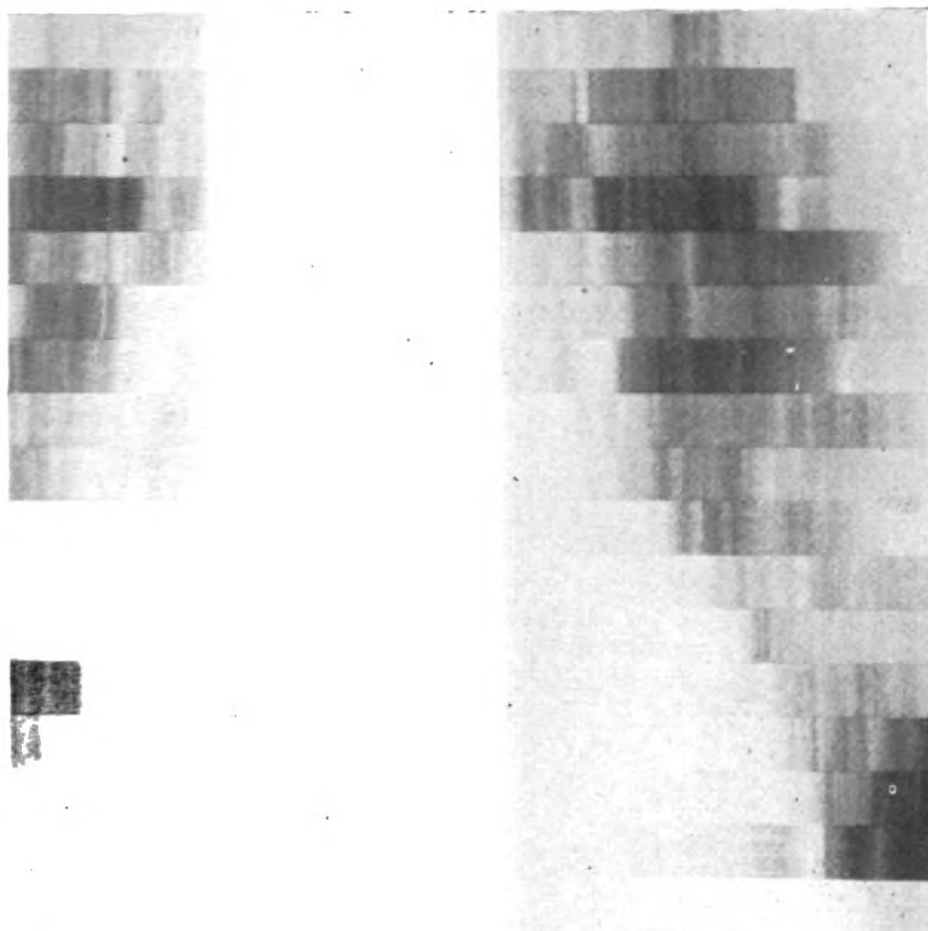
The probable age of the infarct cannot be determined from a single kymogram. The kymographic changes in cases of recent infarction are, in general, quite similar to those in cases of old infarction. A minority of cases of acute infarction will show (1) no immediate changes but changes developing after from 4 to 12 weeks, or (2) immediate changes, with gradual improvement and return to normalcy after several months.

In summary, positive kymographic findings in myocardial infarction are (1) localized diminution or absence of pulsation, (2) systolic expansion or paradoxical pulsation, and (3) partial systolic expansion or marked diastolic irregularities. Negative kymographic findings do not exclude the possibility of infarct, but appear to occur in less than 30 percent of cases. Positive findings are most conspicuous in cases of severe or extensive infarction.

INDICATIONS FOR ROENTGENKYMOGRAPHY

The electrocardiograph is so far superior to the kymograph for the detection and confirmation of myocardial infarction that the question arises as to when one should employ roentgenkymography. In general it is indicated when the clinical diagnosis is in doubt, or when the electrocardiographic findings are lacking or equivocal in a patient with symptoms of coronary disease or coronary insufficiency (4). It may be useful also in the prognosis of some atypical cases, since the degree of kymographic change or abnormality usually parallels the extent or severity of infarction.

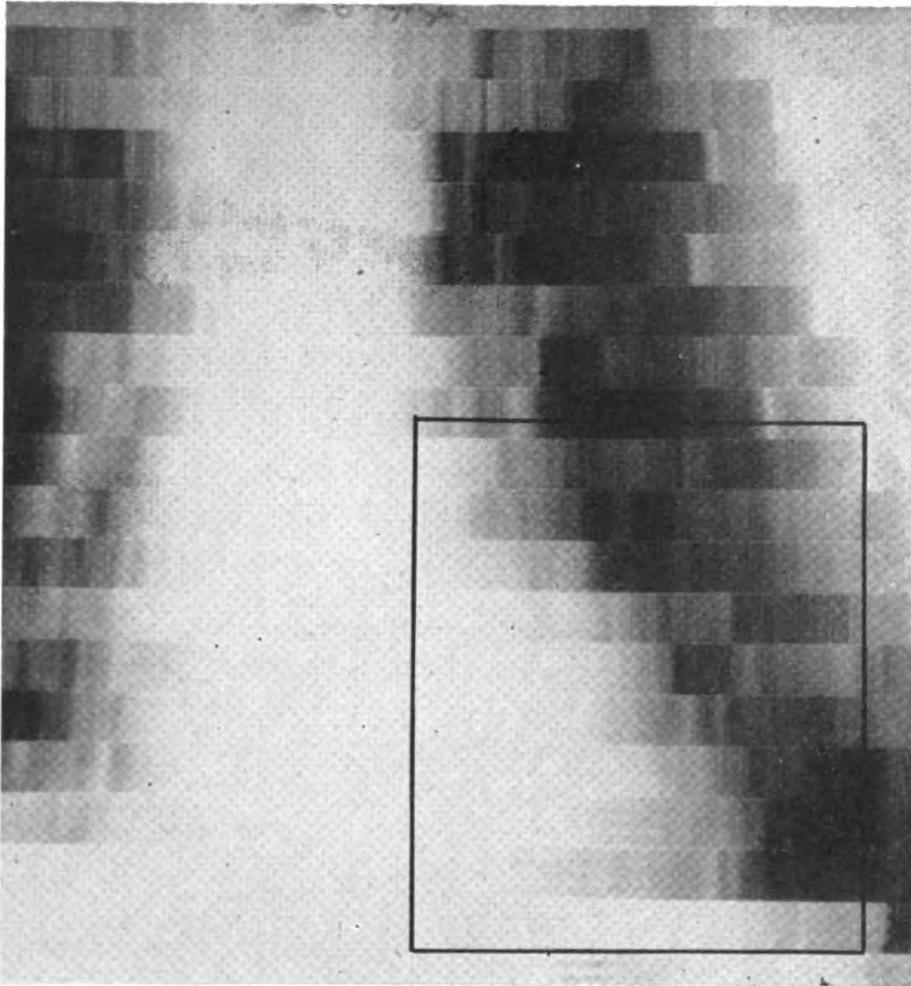
Reliability of roentgenkymographic diagnosis.—In experienced hands, the method is fairly reliable. Positive kymographic findings have been reported in as high as 91 percent of cases of



1. Postero-anterior roentgenkymogram made on 21 April 1944 showing waves of poor amplitude over the left ventricular border, with reversed pulsation in frames 3 to 5 above the left hemidiaphragm. Conclusion: Probable myocardial infarction.

proved myocardial infarction (7). Sussman and his associates reported positive findings in 75 percent of 200 clinically definite cases of infarction. Others have reported such findings in 71 percent of cases (8). I have obtained positive findings in 66 percent of patients with clinically definite lesions. However a few instances have also been encountered of unexplainable silent frames in healthy young persons. None of these could reasonably be attributed to localized infarction or adherent pericardial scar. They may have been due to anomalous but physiologic pendulum or other movements. The following is a case in point.

Report of a case.—A Navy officer, aged 48, was admitted to the sick list on 19 April 1944, with a diagnosis of angina pectoris. He stated that he had had some precordial pain precipitated by effort on three occasions during the previous 6 weeks. The first attack occurred while he was mowing the lawn and persisted for about 20 minutes. None of the attacks were nocturnal. The



2. Postero-anterior roentgenkymogram made on 25 May revealing findings similar to those previously noted. Autopsy subsequently confirmed the findings; there was an extensive infarct involving a portion of the anterior wall of the left ventricle and the lower part of the interventricular septum.

last attack followed a heavy meal, and the pain shifted to the epigastric area. It was relieved by taking sodium bicarbonate but not by nitrites. He was in no distress after entering the hospital.

Physical examination failed to disclose any pertinent abnormality. The pulse rate was 84 and blood pressure 130/94. An electrocardiogram made elsewhere on the day before entry was examined by two cardiologists and reported to be within normal limits. The ocular fundi were negative for evidence of arteriosclerosis. Results of laboratory examinations of the blood and urine were negative.

On roentgenographic examination 2 days after admission the heart and aorta appeared to be within normal limits in size and shape, but ventricular contractions were poor. The lungs were clear. A cardiac kymogram disclosed waves of poor amplitude over a portion of the left ventricular margin, near the apex, with paradoxical motion in frames 3 to 5 above the left diaphragm. These findings were interpreted as probably being due to infarction.

The patient was kept at bed rest for 10 days and complained intermittently of mild epigastric distress. This was unaffected by nitroglycerin, amyl nitrite or medicinal amounts of alcohol, but was immediately relieved by sodium bicarbonate and subsequent eructation. Roentgenographic examinations of the gallbladder and stomach showed no abnormality. The patient was allowed gradual resumption of exercise; he could walk on level ground without distress and after 4 weeks was eager to return to his light duties as a training school supervisor. He felt so well that in view of the negative electrocardiographic findings it was doubted that there was any significant myocardial lesion.

Kymograms made 5 weeks after entry to the hospital confirmed the presence of "waves of poor amplitude over a portion of the left ventricular margin, consistent with localized infarction of the wall of that ventricle." A repeat electrocardiogram next day showed some change, principally in the fourth precordial lead, which now revealed slight depression of the ST segment and inversion of the T wave. Until this second electrocardiogram became available, the only direct evidence of myocardial infarction was the kymogram.

The patient continued to feel well and was discharged home, pending completion of his survey, with the diagnosis of angina pectoris. On the evening after his departure he was awakened at 2200 with severe epigastric pain; he took nitroglycerin without relief and then sodium bicarbonate with some relief. He slept again until about 0100, when he awoke with severe chest pain, went into shock, became pulseless and died in less than an hour.

Autopsy disclosed patchy coronary sclerosis, with thrombosis of the interventricular branch of the left coronary artery at its origin. There was extensive, fresh infarction of the lower part of the interventricular septum, and a portion of the anterior wall of the left ventricle. Older scarring of the posterior surfaces of the right ventricle near the apex was evident. There was also moderate generalized arteriosclerosis.

SUMMARY AND CONCLUSIONS

1. Roentgenkymography is a valuable adjunct in the diagnosis of myocardial infarction.
2. It is especially useful in cases with equivocal or negative electrocardiographic findings.
3. The criteria suggestive of myocardial infarction are outlined.
4. An additional case is reported in which the kymographic findings led to a correct diagnosis of infarction, despite negative electrocardiographic and indefinite clinical findings. The diagnosis was verified at autopsy.

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CLASSIFICATION OF ANEMIAS

The terms "secondary anemia" and "primary anemia" must by now be considered as clearly outmoded. Since anemia is always a symptom of some underlying disorder, all anemias are necessarily secondary. If this is the case, there is no point in discriminating between primary and secondary cases. The classification of anemia on the basis of color index, cell volume or cell diameter, or all three, has become deservedly popular, chiefly because it gives orientation regarding the possible etiologic and therapeutic factors in a given case. Thus hypochromic microcytic anemia is usually indicative of chronic iron deficiency and of a probable therapeutic response to iron rather than to liver.

For a complete classification, cell size and color index are, however, not enough; the important consideration is the cause of the anemia. In every case it is essential, preferably before therapy is begun, to attempt a definition of etiologic factors. This can generally be done if it is remembered that anemia is usually due to one of three factors: A deficiency of materials requisite for blood formation; a disturbance in the marrow; or an increased loss of the bone-marrow's finished product, the red cell, either through hemorrhage or increased hemolysis.

Thus a given case may be classified as follows: Macrocytic anemia, inadequate intake of protein, gastric achlorhydria—that is, liver-extract deficiency or pernicious anemia; microcytic, hypochromic anemia, inadequate intake of iron, gastric achlorhydria, profuse menses—that is, chronic hypochromic, iron-deficiency anemia; or normochromic, normocytic anemia, benzol-poisoning—that is, aplastic anemia.—DAMESHEK, W.: *Hematology*. New England J. Med. 232: 250-255, March 1, 1945.

MUMPS ORCHITIS

WITH A DISCUSSION OF PLASMA PROPHYLAXIS

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Mumps as a morbidity problem in the armed services assumes major importance. In World War I there were 230,356 cases among 4,000,000 American troops (1). Wesselhoeft (2) states that it ranked third among the diseases which caused time lost in that war. The experience of this war is similar. The statistical section of the Annual Sanitary Report for the Year 1943, submitted to the Bureau of Medicine and Surgery by this activity shows that the respiratory diseases rank first in time lost, venereal diseases second, and mumps third. The report also shows that mumps was responsible for more time lost than either syphilis or gonorrhea.

Orchitis is a common complication of mumps. Stengel (3) found that it occurred in 18 percent of over 1,000 cases collected. Macleod (4) studied 694 cases in which 20 percent developed orchitis. In 142 cases which we have personally collected, the incidence of orchitis was 26 percent. The additional time lost due to orchitis and the resultant morbidity is a matter of concern.

The causative factor is commonly accepted to be a filtrable virus. This was first demonstrated by Granata in 1908, later by Nicolle and Conseille in 1913 and by Wollstein in 1918 (5). These investigators showed that the virus was present in the saliva and was excreted by the parotid gland. Wollstein was able to produce parotitis, meningitis and orchitis by direct inoculation of the virus. According to more recent research, the virus is always present in the spinal fluid (6). Bezancon et al. (7) and Philibert (5) are of the opinion that the virus localizes in the central nervous system and from there it metastasizes to the parotids, the testes, or the pancreas.

According to Herman (8), "the pathologic changes in the condition are degenerative rather than inflammatory. A slight hydrocele can be observed surrounding an enlarged, bluish, tense,

elastic, ecchymotic organ. Edema is often seen. There is frequently an irregular involvement of the tubules, while certain tubules seem to escape the toxic and pressure effects. With severe involvement, the majority of the tubules show hyaline degeneration with cellular necrosis. There are deposits of fibrin; red and white blood cells may be present. The epididymis may be acutely inflamed. In late stages the testis is small and flabby, due in large part to destruction with replacement by connective tissue."

We have found involvement of the epididymis to be a frequent occurrence although few observers mention this complication. One of our patients developed a severe bilateral epididymitis which preceded a severe bilateral orchitis by 2 days.

Involvement of the testis usually follows the appearance of the parotid swelling. It can occur in from 1 to 12 days, usually about the fifth to the seventh day. Four of the 23 cases of orchitis which we recently observed were present on the first day of the parotitis. The temperature curve normally varies from 101° to 105° F. and severe chills are not infrequent. The duration of fever may be from 2 to 10 days; the average duration was 3 to 5 days. In 17 patients with orchitis, the fever terminated by crisis in 9 instances. The other 8 terminated by lysis over a 2- or 3-day period.

Orchitis can occur before, coincidental with, or without the parotid swelling. We did not observe any case of orchitis which preceded the parotitis. Dermon and Le Hew (9) mention three such cases in their study. Rabinowitz and Seligman (10) reported a case of primary mumps orchitis without parotitis. There was a history of exposure 2 weeks before to a case of mumps in the patient's family. Harris and Bethell (11) recorded two cases of meningo-encephalitis and orchitis as the only symptoms of mumps. In our series one such patient was encountered. A man complaining of headache and fever of 1-day duration was admitted with a diagnosis of meningitis. A spinal puncture showed 450 cells. No organism was noted on direct smear. Culture of the fluid was later reported as negative. Two days after admission the patient developed a bilateral orchitis. He never showed parotid swelling.

Although many have an opportunity to observe patients with mumps orchitis, few are able to follow any large group for a considerable period of time to observe the ultimate fate of the involved testes. The ideal method of study would naturally be a continuous and uninterrupted observation from the onset of the disease, but this is almost impossible. As a practical substitute, 2,368 men were interrogated to determine how many had had mumps. (There are certain errors in this method, such as errors

of diagnosis originally, failure of men to remember whether or not they had the disease, or desire of some men to conceal a complication such as orchitis.) There was no bias in selection, for the 2,368 represented five consecutive drafts of men sent for training to one of the schools at this activity. They ranged in age from 17 to 38 years and came directly from boot camp. Such desirable information as to how much of the particular population under study was drawn from rural or from urban communities was not determined. One thousand, one hundred twenty-two men, or 47.3 percent, gave a history of mumps. The age of occurrence was noted for each one. Forty-nine who gave a history of orchitis as a complication were examined physically to determine the state of their gonads. Their ages at the time of examination were recorded.

Table 1 is a résumé of the incidence of mumps and mumps orchitis in five groups of men arranged according to age at time of occurrence.

TABLE 1.—Incidence of mumps and mumps orchitis according to age group

Group	Age group in years									Total	Percent of mumps
	No. of men	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39		
A	449	11	112	83	31	6	3	1	0	247	55.0
B	757	15	125	88	40	12	0	0	0	280	36.9
C	442	8	74	77	18	5	0	0	1	183	41.4
D	332	27	65	55	22	4	3	0	0	176	53.0
E	388	23	94	78	34	5	1	1	0	236	60.8
Total	2,368	84	470	381	145	32	7	2	1	1,122	47.3
No. cases of orchitis		0	0	16	25	7	1	0	0	49	—
Percent of orchitis in each age group.		0	0	4.2	17.2	21.8	—	—	—		
Percent of orchitis in age groups 15-39					17.6						

Of the 2,368 men, 1,122, or 47.3 percent, gave a history of mumps. No case of orchitis under 10 years of age was recorded. One case at 10 years was noted. The other 48 cases occurred at 12 or more years of age. From 10 to 14 years of age the incidence was 4.2 percent. From 15 to 19 years it was 17.2 percent and from 20 to 24 years it occurred in 21.8 percent of the men. No conclusions were drawn from the other age groups because of the small number in each group. The incidence of orchitis in all groups from 15 to 39 years of age was 17.6 percent, which agrees closely with other investigators.

Of the 49 cases of orchitis, atrophy of the testes was found in 27 instances, or 55 percent. Nine testes were atrophied to approximately one-third normal size. Twelve were one-half the size of the normal gland; 6 were approximately two-thirds normal

size. Forty-five percent of the cases of orchitis showed no atrophy. The average length of time which elapsed between the occurrence of the orchitis and the present study was 7 years for the group which showed atrophy and $5\frac{1}{4}$ years for the group which showed no atrophy. There was no correlation between the occurrence of atrophy and the age groups when the mumps appeared.

Two control groups were selected at random from the 2,368 men. A physical examination of each man was done, with particular reference to the presence of atrophy of the testes. The first group consisted of 145 men with no history of mumps. They were studied to determine how frequently atrophy of the testes might occur due to conditions other than mumps. The second group was made up of 163 men with a history of mumps without orchitis. These men were studied to determine (1) how many men in such a group might conceal the occurrence of orchitis as a complication, and (2) how many might not have remembered the complication.

Table 2 is a résumé of the examination of two control groups, studied for atrophy of the testes.

TABLE 2.—*Testicular abnormality in mumps and control groups*

History of mumps	No. of men	Abnormality of testes	Atrophy of testes possibly due to mumps
Absent.....	145	2*	0
Present.....	163	3**	1
Total.....	308	5	1

*Two cases of undescended testis.

**Of these three, one man had a large varicocele with only slight atrophy of the testis. One man gave a history of trauma while playing soccer, with subsequent soreness of the testis.

These two control series show that in 308 men, 2 instances of atrophy of the testes occurred, due to causes which might be other than mumps. In the mumps group of 163, one man was found to have atrophy with no other history than mumps to explain it. This man recalled no orchitis with his mumps. It is hardly likely that he would not remember such a complication if he remembered his episode of mumps. However the possibility still exists that he had had an orchitis. Since unexplained cases of testicular atrophy were found to occur one time in 163 cases of mumps patients who gave no history of orchitis, it is reasonable to assume that there were 7 such cases that were not discovered among the 1,122 men who had mumps. A corrected figure, then, for orchitis due to mumps in the 1,122 men, might be 49 plus 14, or 63 cases. Fourteen is added because for each patient with atrophy there was one

who had escaped atrophy. From the aforementioned data only 55 percent of orchitic cases were followed by atrophy.

The diagnosis of orchitis due to mumps offers no difficulty when the complication follows closely after parotid swelling. However the problem of diagnosis is more difficult when there has been no antecedent parotid, submaxillary, or sublingual gland enlargement. The appearance of an isolated orchitis in a person, 2 or 3 weeks after another member of his family had mumps, is highly suggestive of mumps orchitis. Since the extent of parotid swelling is variable from patient to patient, it is possible for the swelling to be slight and disappear rapidly. If such a patient develops orchitis, a history of slight facial swelling is important. A history of pain in the jaws or a visit to the dentist because of slight swelling of the face is significant.

Since a pleocytosis of the spinal fluid is a common concomitant of mumps (12), the finding of an increased number of cells in the spinal fluid is evidence that the orchitis was due to the virus of mumps. A man was recently seen at sick call with slight sore throat and a little swelling of the neck. He was told that he had a mild tonsillitis. Seven days later he was admitted to the hospital with a bilateral orchitis and with no evidence of facial swelling. A spinal tap showed 28 lymphocytes per cubic millimeter of spinal fluid. This was definitely abnormal. The combination of orchitis and meningitis as evidenced by an increased number of cells in the spinal fluid is strong evidence for mumps. The presence of clinical meningitis associated with orchitis often is diagnostic of mumps orchitis even before confirmation by the finding of an increased number of cells in the spinal fluid. It is of importance to inquire as to headache, and to test for rigidity of the neck in every patient seen with a swollen gonad of undetermined cause.

Applebaum's (13) recent study of serum amylase in mumps may offer us another procedure to establish the presence of mumps. He showed that in a series of patients without mumps, the range of serum amylase was 40 to 175 mg. per 100 cc. (Somogyi's method), whereas in a group with parotid swelling, the average level was 502 milligrams. His work also demonstrated that persons with bilateral parotitis were apt to have higher blood levels than those with unilateral involvement. In his cases of bilateral parotitis, the serum amylase was elevated even on the ninth to the eleventh day to levels of 340 milligrams.

Thus it would seem, theoretically, that given a patient with orchitis, whose facial swelling had disappeared before observation, the finding of an elevated serum amylase would be an additional

bit of evidence for a diagnosis of mumps. This particular problem is now being studied.

Snapper (6) has recorded some observations on increased urinary diastase in mumps without pancreatitis. Further studies would be of value to see whether or not these findings occur consistently and whether they could be utilized to aid in the diagnosis of mumps. There are, therefore, several important factors to determine which may aid in the diagnosis of mumps when orchitis is the presenting sign and when there is no evidence of swelling of the parotid or other salivary gland. These are (1) a history of contact with a case of mumps, (2) the presence of signs of clinical meningitis, (3) the presence of a pleocytosis in the spinal fluid, and (4) an increase in level of blood serum amylase (this, however, has not been fully studied).

The report of Rambar (14) on the treatment of two patients with mumps orchitis by the administration of pooled plasma was most interesting. The two patients who were cited showed a prompt fall in temperature within 24 hours after the injection of plasma.

In the same issue of the periodical in which Rambar's article appeared, Candel and associates (12) published two temperature charts of patients with mumps orchitis. The first represented a case of orchitis which occurred on the eighth day after the appearance of parotitis. The temperature dropped abruptly to normal within a period of 24 hours on the third day after the onset of orchitis. The second showed the course of a case of mumps and orchitis, both of which occurred simultaneously. On the ninth day of fever, the temperature dropped to normal abruptly within a 24-hour period. The fall in temperature of both patients was associated with an amelioration of symptoms. Because in our present study 9 out of 17 cases of orchitis terminated by crisis, it seems that a sudden drop of temperature following the use of plasma is not sufficient evidence to establish the value of plasma as treatment. In four of the patients who first received 100 cc. of plasma intravenously on admission as a possible prophylactic and then received 250 cc. of plasma when orchitis appeared, only one showed a sudden drop of temperature after 24 hours. Two of the other three showed a normal temperature 2 days after injection. The third took 5 days to return to normal.

The possibility that pooled plasma might contain sufficient antibodies to treat mumps, as suggested by Rambar, prompted us to determine whether or not it contained enough antibodies to protect against orchitis. The following experiment is concerned with observations on 105 patients with mumps. Seventy-five served as control group and 30 made up the experimental group. Each of

the 30 patients in the control group received 100 cc. of pooled plasma immediately on admission.

Table 3 is a résumé of our findings.

TABLE 3.—*Incidence of orchitis as influenced by plasma**

	No. cases	No. cases orchitis	Percentage of patients with orchitis
Control group (no plasma)	75	17**	22.6
Experimental group (plasma)	30*	6**	20.0

* Each received 100 cc. of pooled plasma intravenously on admission.

** Two patient in each group had orchitis on admission.

It is apparent on inspection of the figures above that 100 cc. of pooled plasma does not contain enough antibodies to protect against orchitis.

In 1942 Enders and Cohen (15) reported a method for the detection of antibody in the sera of man and monkey convalescent from mumps. In 1943 Enders (16) demonstrated the presence of antibodies in the blood stream of mumps patients. He showed that no antibodies were present in the first 2 days, after which the titer increased. The convalescent titer fell to approximately normal levels within 7 months, to a level comparable to that found in many normal persons.

Hess (17) was the first investigator to report the use of convalescent blood in the prophylaxis of mumps. Johnson and Goodpasture (18) found difficulty in inducing infection except by intraparotid inoculation and found that attempts to confer passive immunity usually failed. Block (19) obtained no evidence for any considerable amount of antiviral substance in serum or saliva. On the other hand, investigators such as de Lavergne and Florentin (20), Teissier (21), and Hinckley (22) showed that convalescent serum had a remarkable effect in reducing the incidence of orchitis as a complication of parotitis in patients treated with convalescent serum as compared to mumps patients who received no serum. The Council on Pharmacy and Chemistry (23) of the American Medical Association concluded that human convalescent serum seemed to be of therapeutic value in the hands of some investigators while in others the results were less certain.

The work of Bailey and Haerem (24) is of special interest. These authors studied 734 cases of mumps, the patients being between 18 and 35 years of age. Five hundred fifty-one patients served as controls; the incidence of orchitis in this group was 19.9 percent. The experimental group, comprising 183 patients, received 10 or 20 cc. of convalescent serum; the incidence of orchitis

was 15.3 percent. They found that when the group of 183 was broken down into 135 who received convalescent serum from patients without orchitis, and 48 who received convalescent serum from patients with orchitis, the incidence of orchitis in the 135 was 19.2 percent and the incidence in the 48 was only 4.2 percent. They concluded that the occurrence of orchitis in the convalescent mumps donor is apparently an important factor in determining the value of his serum in preventing orchitis in the recipient. They advanced two theories to explain this: (1) That orchitic involvement might be capable of producing serum antibodies which specifically protect the recipient from orchitis; (2) that the orchitic involvement might be associated with a more highly antigenic type of mumps.

Rambar's use of plasma to treat mumps orchitis was a very rational procedure. Enders, however, demonstrated that 7 months after mumps, the serum of the convalescent contained a quantity of antibody no different from the normal. It is hardly likely, therefore, that a chance batch of plasma would contain a great deal of antibody. Our own experience with plasma in prophylaxis shows that even though we used from five to ten times the volume of plasma as compared with convalescent serum employed by Bailey and Haerem, there was not enough antibody present in the plasma to affect the incidence of orchitis. To employ very much larger amounts of plasma would not be economical. It is unfortunate that the method of Enders and Cohen for the determination of the quantity of antibody in serum is such a difficult one to employ generally. These workers have stated that the extensive application of their test will depend upon the discovery of a more readily available and cheaper source of antigen. The quantitative method of Enders and Cohen would enable research with plasma or serum to be carried on in a more exact manner. The observations of Bailey point out very definitely that patients with mumps orchitis, will, in all likelihood, be the best source for the procurement of convalescent serum or plasma.

The high incidence of orchitis in mumps of adults makes the discovery of a good method of preventing the complication an urgent problem. There are many who emphasize the importance of bed rest in the prophylaxis of orchitis despite lack of well-controlled experimental work substantiating it. The groups here studied for effect of plasma were kept in strict isolation and, due to the limited quarters, were confined to bed except for head privileges. The incidence of orchitis in the entire series was 21.9 percent, which is similar to the incidence of orchitis reported in many other series. Dermon and Le Hew (9) quote the work of Radin

who in 1918 showed that strict bed rest alone did not lower the incidence of orchitis as a complication. There has been no controlled study which showed that "slight injury to the testes predisposes to the development of orchitis, and care should be taken to avoid traumatism, however slight, or even examination by palpation" (1).

Human convalescent serum seems to be of value in the hands of some investigators while in others the results are less certain. Intravenous administration of 100 cc. of pooled plasma did not affect the incidence of orchitis in this study. Whether larger amounts would be of value is speculative. Rambar suggested the use of pooled plasma intravenously in the treatment of the complication of orchitis. Its value has not been established. Results of the use of sulfadiazine in treating a few patients of this group were not impressive. Dermon and Le Hew have reported a like experience and refer to the similar experience of Haerem who studied a larger group of patients in 1943.

Treatment at present is purely symptomatic, with rest in bed, elevation of the testes by a bridge, application of an ice bag, and codeine sulfate and salicylates for the relief of pain. The patient is permitted out of bed after his temperature has returned to normal and all evidence of orchitis is gone. He is discharged to duty after the erythrocyte sedimentation rate is normal (25).

SUMMARY

1. Mumps and mumps orchitis are still urgent Naval and military problems.
2. Of 2,368 men who had just completed boot training, a history of mumps was obtained in 1,122, or 47.3 percent; and a history of mumps orchitis as a complication was found in 49 men according to the following age groups: None occurred under 10 years of age, 1 occurred at 10 years of age, and 48 occurred at 12 or more years of age. The incidence of orchitis following mumps at 10 or 14 years of age was 4.2 percent; at 15 to 19 years of age, 17.2 percent; and at 20 to 24 years of age, 21.8 percent. Atrophy of the testis was found in 55 percent of cases of orchitis.
3. Epididymitis is frequently associated with the orchitis of mumps.
4. The diagnosis of mumps orchitis without parotid swelling is discussed.
5. Prophylaxis and treatment of orchitis is presented.
6. Pooled plasma, 100 cc., given intravenously to mumps patients as a prophylactic, does not lower the incidence of orchitis.

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SULFONAMIDES IN DIARRHEAS

Over 1,400 cases of diarrhea furnished the basis for this study. After trying many forms of sulfonamide treatments, a combination of sulfaguanidine 3.5 gm. and sulfathiazole 1 gm. thrice daily was found to be the most effective. It reduced the hospitalization of uncomplicated common diarrhea from seven and two-tenth days to five days and cleared all but 4 percent of infections due to gram-negative bacilli, with 6 days' therapy in 47 patients treated.—JACOBY, A. H.; LOUDON, J. R.; WYNE, P. S.; and FAILMEZGER, T. R.: Diarrhea problem in New Guinea base. Bull. U. S. Army M. Dept. 86: 70-78, March 1945.



HEADACHE CAUSES

Traction displacement, distention, and inflammation of cranial vascular structures are chiefly responsible for headache. Pain referred to the head from disease of tissue not in the head does not occur, with the rare exception of pain in the jaw or neck with angina pectoris. Sepsis or fever of any origin may be associated with headache, but this is not referred pain. The inference is that the mechanism of headache as a symptom of disease outside of the head is dependent upon a vasomotor phenomenon. Brain tumor headache is produced by traction upon intra-cranial pain-sensitive structures, chiefly the large arteries, veins and venous sinuses, and certain cranial nerves.

Observations of the amplitude of pulsations of the cranial arteries during headache associated with experimentally induced fever showed that the spontaneous increase and decrease of intensity of the headache paralleled the changes in amplitude of pulsations in these arteries. The observation was made that increasing the cerebrospinal fluid pressure in the subarachnoid space relieved fever headache.—BOIES, L. R.: The symptom of headache. Journal-Lancet 64: 400-404, December 1944.

PYELONEPHRITIS: ITS NEWER CONCEPT AND CLINICAL SIGNIFICANCE

WITH A REVIEW OF THE LITERATURE

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For many years the clinical syndrome of prostration with chills, sweats, fever, flank pain, and pyuria was labeled "pyelitis" in the belief that the disease was an infection of the pelvis of the involved kidney. The consensus was that inflammatory changes were the result of an "ascending" infection of the urinary tract generally secondary to obstruction in the urethra, prostate, bladder, or ureter. "Pyelitis" was considered a benign and transient infection having no important sequelae.

Recently, however, a far different concept of the disease has arisen. In their classic monograph on the subject Weiss and Parker (1) point out that the infection involves the entire nephron, its vascular and lymphatic systems, and the interstitial tissue as well. They emphasize that the disease may persist with bacteriuria and pyuria for years, that the inflammatory changes associated with the disease may eventually give rise to renal failure, and that these changes may also produce arterial hypertension. They estimate that "pyelonephritis is responsible for at least 15 to 20 percent of cases of malignant hypertension."

Although the present interpretation of pyelonephritis is of recent origin, there had been isolated suggestions regarding its pathogenesis. But not until 1933 with the work of Longcope and Winkenwerder (2) was the importance of the disease to internal medicine pointed out. The monumental work of Goldblatt and his associates on the relationship of renal ischemia to hypertension gave great impetus in the next few years to the study of renal vascular changes. Longcope (3) in 1937 mentioned that hypertension is often associated with the disease. In 1939 came the classic clinicopathologic correlation of Weiss and Parker which was followed shortly by the experimental production of the disease by Mallory and his associates (4).

It is the purpose of this report to summarize the most important work on the subject and to present five illustrative cases occurring in young Naval personnel. Pyelonephritis is of importance in the

armed forces, and adequate treatment today may prevent serious sequelae in the veterans of tomorrow.

Prevalence.—Acute pyelonephritis is relatively common in early childhood, pregnancy, and in old age. That the disease is not rare is illustrated by Kinney and Mallory's (5) figures in 1,000 consecutive autopsies from the Boston City Hospital. Fourteen percent showed evidence of some form of pyelonephritis. From the same clinic over a 5-year period the diagnosis of glomerulonephritis was made 106 times but pyelonephritis was diagnosed 272 times (1). Staemmler (6) reported on 55 contracted kidneys studied at autopsy, of which 27 were nephrosclerotic, 18 pyelonephritic, and 10 glomerulonephritic. The common association of renal infection with urinary obstruction is well illustrated by Bell's (7) series of 1,229 autopsied cases of hydronephrosis, of which 60 percent showed pyelonephritis. Diabetics also seem more susceptible to the disease. Deming (8) reported on 330 male patients with renal lesions who were within the draft ages (from 18 to 38 years). Of these, 43 (13 percent) had "pyelitis" and pyelonephritis, whereas only 16 (4.8 percent) had "nephritis."

CLINICAL PICTURE

Acute pyelonephritis.—The acute onset of prostration with systemic symptoms of infection (chills, sweats, fever) associated with dysuria, pain over one or both kidneys, and loin or costovertebral angle tenderness, accompanied by hyperpyrexia, tachycardia, leukocytosis, and pyuria is a familiar syndrome. The presence of bacteriemia or bacteriuria is a contributory finding. Frequently in children and infants urinary tract abnormalities are present. In adults obstruction in the urinary tract, such as urethral stricture, prostatic enlargement, bladder tumor, or urinary tract calculus often occurs. As a rule the typical case of acute pyelonephritis is not difficult to diagnose, and only when diabetic coma or renal failure clouds the picture does the diagnosis become difficult.

As most acute pyelonephritis is probably hematogenous in source, the earliest signs and symptoms of the disease may simulate those of any infection giving rise to systemic reactions. However localization to one or both kidney regions is usually an initial feature of the disease. For that reason the low-back myalgia of catarrhal fever, also associated with chills, sweats, and fever, occasionally causes some difficulty in diagnosis, but in catarrhal fever the urinary sediment at most will show only a few leukocytes. Case 2 is an example of such a differential diagnosis.

Acute glomerulonephritis should be recognizable by the marked hematuria, tendency to hypertension, nitrogen retention, edema,

the absence of bacteriuria and the very few leukocytes in the urinary sediment. Symptomatic urinary calculus unaccompanied by infection is chiefly differentiated by a normal temperature and normal leukocyte count, colic, hematuria, and roentgen-ray findings if the calculus is opaque.

Frequently calculi, polycystic kidneys, congenital anomalies, hydronephrosis, and occasionally tumors are complicated by the presence of acute or chronic pyelonephritis, and it may be the signs or symptoms of one of the latter diseases which prompts the investigation leading to discovery of the former. Rarely abdominal disease, such as retrocecal appendicitis in which the appendix lies high in the abdominal cavity, simulates pyelonephritis. Retroperitoneal infections, tumors, and hemorrhages also enter into the diagnosis, and differentiation may be difficult.

Chronic pyelonephritis.—After an acute episode of pyelonephritis, symptoms may regress yet the patient may not recover his full strength. Further urinary examination often reveals a bacteriuria and pyuria which may last for years. Persistence of renal signs is frequently associated with malaise, vague gastro-intestinal complaints, occasional episodes of abdominal pain, backache, episodes of chills and fever, occasional dysuria, and passing of cloudy urine. Hematuria and cylinduria may be prominent features at times and lead to the erroneous diagnosis of chronic glomerulonephritis. Eventually after some years the disease may lead to renal impairment or hypertension or both.

Once renal failure or hypertension occurs, there is nothing specific about either of these to differentiate one of pyelonephritic origin from other types, although the renal failure of chronic pyelonephritis may run a variable course. Weiss and Parker point out that they have seen pyelonephritic patients with uremia, coma, and pericarditis recover and have adequate renal function for many years. They also point out that malignant hypertension of chronic pyelonephritic origin is more apt to terminate in renal failure and to have a lesser incidence of cardiovascular complications than is malignant hypertension of other origin.

In any vague chronic illness with general malaise, lack of strength, and anemia, even without localized urinary complaints, examination of the urine is obligatory. Once the renal tract has been implicated the differential diagnosis becomes difficult.

Mansfield, Mallory, and Ellis (9), after examining the clinical records of 59 patients whose kidneys at autopsy showed pathologic findings typical of the various chronic nephritides, state, "there is no pattern of urinary findings pathognomonic of any one type of nephritis." They found that patients with benign nephrosclerosis

might show hematuria, as pyelonephritic patients frequently do; that patients with chronic glomerulonephritis might show pyuria, cylinduria, and no hematuria; and that in malignant nephrosclerosis any abnormal urinary element might be frequently found, as also may occur occasionally in any of the common renal lesions. However pyuria was always found in the urine of patients with chronic pyelonephritis, although it could also occur in other renal diseases. A history of acute pyelonephritis was rarely elicited in the chronic pyelonephritic group, indicating that many attacks probably go unrecognized. Chronic pyelonephritis occurred at all ages. The nephrotic syndrome did not occur with the pyelonephritic group, only with the glomerulonephritic. Although uremia of long standing might occur in pyelonephritis, it was less frequent than in glomerulonephritis and benign nephrosclerosis.

Thus in renal failure definite diagnosis might be difficult, a fact well illustrated by the 32 patients with pyelonephritis dying in uremic coma reported by Likely and his coworkers (10). Only 5 cases were diagnosed before death.

Healed pyelonephritis.—Most cases of acute pyelonephritis probably heal, leave only small residual scars, and do not give rise to serious impairment of renal function. There are cases of recurrent acute pyelonephritis, such as acute episodes during pregnancy, that go on to complete healing, and there are probably many cases of chronic pyelonephritis that heal completely, especially since the advent of sulfonamide therapy.

In healed pyelonephritis the diagnosis is very difficult. The urinary findings are minimal and pyuria is absent. Terminally there may be a well marked hypertension, and in 7 of their 9 cases Mansfield et al. found retinitis with papilledema. This also occurred in 9 of 10 cases of malignant nephrosclerosis, but in only from 25 to 50 percent of other groups. The disease may also lead to renal failure. Patients who die from the disease are usually in youth or early middle age, they have no previous history suggesting acute glomerulonephritis, and only rarely is a history of acute pyelonephritis present. Twenty-six of Weiss and Parker's 38 patients showing healed pyelonephritis at autopsy had hypertension clinically.

Bacteriology.—Two organisms are commonly present in renal infections, namely, the *Escherichia coli* and *Staphylococcus aureus*. Putschar (11) states that *Escherichia coli* is responsible for 90 percent of the cases in childhood and *Staphylococcus aureus* for from 30 to 40 percent in aged males. Various other organisms have been listed, such as those of the *pseudomonas*, *proteus*, and *aerobacter* groups, and *Hemophilus influenzae*, Eber-

thella typhosa, *Streptococcus faecalis* (12), and Friedländer's and Flexner's bacilli (13).

PATHOGENESIS

EXPERIMENTAL.

It has been believed that bacteria may reach the kidney through three routes: Ascension of the lumen of the ureter from the bladder to the renal pelvis; through the lymphatics of the ureter from the bladder wall; and by way of the blood stream from various foci. Mallory et al. (4) have recently reproduced the disease in rabbits and shown that the histologic criteria established from clinicopathologic correlation (1) (11) are valid. By ligating one ureter of a rabbit and injecting *Escherichia coli* intravenously they were able to produce acute pyelonephritis in the kidney with obstruction to urinary flow in about 75 percent of the animals. Autopsy at various periods after ligation showed the successive stages in the disease. Release of the ligature was followed by healing as demonstrated by autopsy.

The earliest lesions discernible grossly were seen in the pyramids where a few yellow abscesses appeared from 2 to 4 days after injection of the bacteria. After 4 or 5 days multiple abscesses occurred throughout the cortex and pyramids. At this time the kidney was increased in size, the ureters and pelvis were dilated and filled with pus, and the pelvis was thickened, edematous, and showed occasional abscess formation.

Microscopically the first changes were seen from 12 to 18 hours after injection and consisted of masses or thrombi of bacilli in the capillaries and venules of the pyramids, in the vessels about the tubules of the cortex, and in the capillaries of the glomerular tufts. In from 24 to 48 hours necrosis of the endothelium of the blood vessels in the pyramids with surrounding polymorphonuclear infiltration could be seen. In places this reaction had broken through to the interstitial tissue forming abscesses, into the adjacent tubules causing necrosis of tubular epithelium and plugging of the lumen with inflammatory exudate, or had extended into the renal pelvis with necrosis of the pelvic mucosa.

From the second to the third day scattered glomeruli showed bacteria in the capsular space, changes ranging from the presence of a few polymorphonuclear leukocytes to abscess formation and occasionally a periglomerulitis. After 4 or 5 days large cortical abscesses destroying glomeruli, convoluted tubules, and loops of Henle were present; the collecting tubules were intact, dilated and filled with polymorphonuclear leukocytes; and the interstitial and pelvic tissues showed abscess formation. At the end of 7 or 8

days, if the obstruction was not relieved, most rabbits died, showing large confluent or occasionally perinephric abscesses.

Release of the ligature after the development of cortical abscesses was followed by a rapidly healing process. Within 2 weeks the kidney was only slightly enlarged, the ureter and pelvis were normal in size, there was a faint mottling of the cortex and pyramids, and no bacteria were demonstrable.

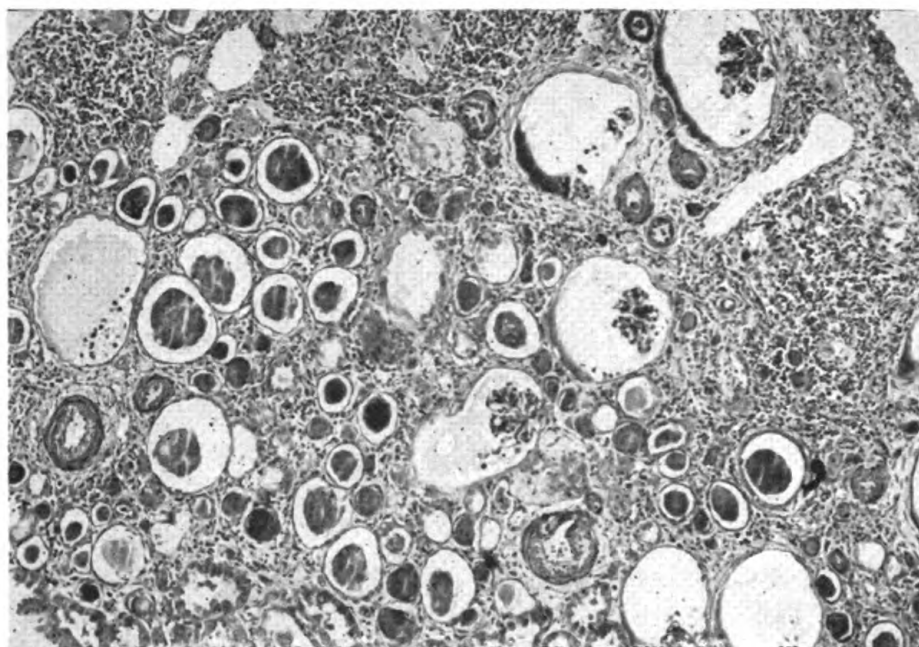
Microscopically there was destruction of glomeruli with hyalinization or periglomerular fibrosis, but many glomeruli were intact although surrounded by inflammation. The interstitial tissue showed a transition from an acute inflammatory response to one of lymphocytes and plasma cells with an increase of connective tissue. The collecting tubules were still filled with polymorphonuclear leukocytes which, after from 6 to 8 weeks, began to disintegrate, fuse, and give rise to the homogeneous, thyroid-like material ("colloid casts") considered characteristic of known chronic or healed pyelonephritis (1) (4). The peripelvic tissue was thickened and infiltrated with foci of lymphocytes and plasma cells. Two months after the acute process had subsided the involved kidney was one-half its original size, showed a slightly granular surface, thinning of the cortex, fibrosis of the pyramids, and thickening of the pelvis.

The vascular changes in the acutely inflamed areas were inflammation and thrombosis of the arteries, arterioles and venules. In the healed kidney medial hypertrophy of the arterioles made these vessels more prominent than usual. Early hyperplasia and sclerosis of the arterioles were present in the healed pyelonephritic lesions of two rabbits. Thus experimental rabbit pyelonephritis is essentially a disease of the renal interstitial tissue which secondarily affects the nephron and the vascular system.

CLINIC PATHOLOGIC CORRELATION.

Weiss and Parker studied histologic material removed from 100 selected autopsied cases (the patients ranging in age from 4 months to 78 years) that had been well studied clinically and pathologically. They divide pyelonephritis into four stages: Acute; chronic (active); healed; and healed, recurrent acute.

Acute.—Typically there is an enlarged kidney with multiple small abscesses extending throughout the cortex, with yellow streaks radiating from pelvis to cortex and with a reddened pelvis frequently covered with exudate. Microscopically, just as in the rabbit, there are multiple foci of inflammation in the intertubular connective tissue which may vary from a few bacteria with polymorphonuclear leukocytes to frank abscess formation.



1. Typical "colloid casts" of pyelonephritis, x 150.

The tubules contain pus; the periglomerular lymphatics, and occasionally the glomeruli, show infiltration of polymorphonuclear leukocytes. The pelvis shows acute inflammatory changes, occasionally progressing to necrosis of the epithelium. Many cases were seen of interstitial involvement without pelvic disease, and the statement was made that "acute pyelonephritis is primarily a disease of the interstitial tissue."

Chronic.—The kidneys may be enlarged, normal or decreased in size. The cortex may show a diffuse, fine granularity indistinguishable grossly from that of benign nephrosclerosis or chronic glomerulonephritis. More frequently it shows irregular, dark, focal areas of scarring accompanied by atrophy of the cortex and frequently surrounded by small areas of nodularity. The pelvis is generally thickened and may show exudate.

Microscopically the interstitial tissue in the involved area is increased and is infiltrated with lymphocytes, plasma cells, and polymorphonuclear leukocytes; the glomeruli show concentric periglomerular scar tissue, and various degrees of sclerosis; some tubules are filled with polymorphonuclear leukocytes and others are lined with atrophic epithelium. Most striking are tubules filled with "colloid casts" (homogeneous material resembling the colloid of the thyroid and believed by Mallory et al. (4) to be trapped, disintegrated polymorphonuclear leukocytes (fig. 1)).

The pelvis shows increased connective tissue and many lymphocytes, plasma cells, and polymorphonuclear leukocytes. The ac-

tivity of the process is indicated by the polymorphonuclear leukocytes in the tubules and interstitial substance.

Healed.—Grossly the kidney is usually smaller than average, shows irregular scarring with atrophy of the cortex in the area involved, and adjacent areas of fine nodularity. There is thickening of the calices and pelves. The irregularity of the scarring, if present, helps to differentiate the lesion from the more diffuse nephritides. Occasionally a healed diffuse process may give a gross appearance similar to diffuse chronic pyelonephritis, benign nephrosclerosis, or chronic glomerulonephritis.

Microscopically, in the involved areas the changes are essentially the same as those found in chronic pyelonephritis except that there are no polymorphonuclear leukocytes in the tubules or interstitial substance (fig. 2).

Healed, recurrent acute.—Obviously this condition would represent a combination of the picture of healed pyelonephritis, together with the findings of acute pyelonephritis already described, and the diagnosis could be made with certainty only by histologic examination.

Microscopic differentiation.—Acute pyelonephritis is primarily a disease of the interstitial tissues. Two other types of interstitial involvement have been classified as “acute interstitial” and “diffuse suppurative” nephritis, although both are probably pyelonephritic responses to different types of offending agents. A pyelonephritis characterized by papillary necrosis and most frequently found in diabetics may also occur (14).

Of the glomerular lesions such as the various stages of glomerulonephritis, alterative glomerulitis, focal embolic glomerulonephritis, and intercapillary glomerulosclerosis, the chief difference between these and pyelonephritis is their lack of colloid casts, the normal pelves and calices, only slight involvement of the interstitial tissue, and the extensive intraglomerular involvement.

Of the vascular lesions of the kidney, benign nephrosclerosis may give atrophy and scarring (confined to the cortex), there are no colloid casts, the interstitial tissue infiltration is lymphocytic, there is no involvement of the pelvis and the arterioles show marked hyaline degeneration of the intima.

Malignant nephrosclerosis shows a diffuse hyperplasia and sclerosis of the arterioles with proliferative endarteritis of the medium-size vessels. There are no colloid casts, and there is no abscess formation; neither is there as much interstitial inflammation as in pyelonephritis (1). Fibrinoid necrosis of vessel walls and glomeruli, hemorrhages, and inflammatory changes, believed

by some to be specific for malignant hypertension are thought by others to be more closely allied to renal failure.

Other kidney diseases, such as polycystic disease, tuberculosis, tumor, hydronephrosis, and renal aplasia or hypoplasia should give no trouble in diagnosis. Frequently combinations of these diseases are found, especially in later life, with such possibilities as benign nephrosclerosis with hydronephrosis and pyelonephritis, or benign nephrosclerosis with a superimposed malignant nephrosclerosis terminating in the alterative glomerulitis of renal failure. They should be readily identifiable microscopically.

Vascular lesions.—In acute pyelonephritis the vascular lesions usually consist of deposition of fibrin and infiltration of polymorphonuclear leukocytes in the wall of an arteriole, capillary or venule. Occasionally partial or complete thrombosis of the vascular lumen or proliferation of the endothelium develops.

Weiss and Parker were first to point out the changes in blood vessels in the scarred areas of chronic or healed pyelonephritic kidneys. In these areas both the arteries and the arterioles may be affected. The arteries show increased connective tissue in the intima, duplication of an internal elastic membrane, and medial hypertrophy ("productive endarteritis"). The arteriolar walls show a striking change, a thickening due to a concentric proliferation of the cells—"hyperplastic arteriosclerosis," so-called "onion peel" type (fig. 3). This latter is believed by Weiss and Parker to be a proliferative change and one to be distinguished from the acellular hyalinization of arteriolar walls, that is, a degenerative change in benign nephrosclerosis and in the arterioles of disuse such as in atrophic uteri.

The hyperplastic arteriolar sclerosis is the type seen also in vessels in malignant hypertension. Because these vascular changes were localized in the scars of pyelonephritis, and because in unilateral pyelonephritis without long-standing hypertension the vascular changes are present only in the pyelonephritic kidney, Weiss and Parker believe these vascular changes precede the hypertension and are the results of the pyelonephritis and not of the hypertension. They believe that the vascular damage gives rise to renal ischemia and thus to hypertension.

Castleman and Smithwick (15) examined renal biopsies taken during sympathectomies for hypertension. They found that hypertension was frequently present with no morphologic evidence of renal disease, but the few instances in which vascular changes in renal vessels were found were in patients with pyelonephritis. However the fact that in unilateral pyelonephritis with long-standing hypertension there are also some similar arteriolar

changes in the nonpyelonephritic kidney led Weiss and Parker to believe that hypertension might, after some time, be a factor accelerating vascular changes.

It has been shown clinically that there is an increase in the thickness of the arterioles of biopsied intercostal muscles in hypertension and this is correlated with levels of blood pressure and mortality (16). That such a vicious circle of inflammation, vascular damage, renal ischemia, hypertension and further vascular damage may occur is suggested also by the recent experimental work of Wilson and Byrom (17). They produced renal ischemia in the rat by clamping the vessel of one kidney. Hypertension developed and vascular lesions in the unclamped kidney were found. After an interval of persistent hypertension, even when the clamped kidney was removed, the hypertension remained in some animals and progressive destruction of the unclamped kidney took place. In case 5, to be reported here, there were vascular changes in nonpyelonephritic areas. These changes were possibly secondary to hypertension.

Pyelonephritis and hypertension.—Longcope first noted clinically in 1937 that in the late stages of bilateral chronic pyelonephritis hypertension is "often" present. Butler (18) examined blood pressure records of eight children ranging in age from 3 to 11 years who were shown at autopsy to have had pyelonephritis. Their blood pressure levels ranged from 140 to 250 millimeters of mercury systolic and from 110 to 170 diastolic with an average of 190 systolic and 140 diastolic. Weiss and Parker reported that of 17 patients with chronic pyelonephritis who died, 14 had had hypertension, in 8 of whom it was severe, and 26 of their 38 patients showing healed pyelonephritis had hypertension.

Braasch and Jacobson (19) analyzed 180 cases of chronic bilateral pyelonephritis and found that in patients under 50 years of age the incidence of hypertension in the pyelonephritic group was twice that of a control group. Braasch et al. (20), in a study of 1,684 patients subjected to renal surgical operation, found 43 patients with primary atrophic pyelonephritis. Of these, 20 (46.5 percent) had hypertension; a control group had an incidence of 20 percent. Shure (21), on the basis of 11,898 autopsies, states that there was a distinct increase in the incidence of hypertension in pyelonephritis, especially in men under 40 years with bilateral involvement. It seems fairly well established that chronic or healed bilateral pyelonephritis that gives rise to extensive parenchymal and vascular damage can give rise to hypertension.

In regard to extensive unilateral disease giving rise to hypertension opinion is divided. Crabtree and Chaset (22) studied 150

consecutive cases in which nephrectomy had been performed for unilateral renal diseases. They state that in unilateral chronic pyelonephritis, hypertension was not the rule. A similar conclusion was reached by others (7) (21). Of Weiss and Parker's 20 autopsied cases of unilateral healed or chronic pyelonephritis, 12 of the patients had had hypertension.

Relation to renal failure.—Because pyelonephritis is a diffuse disease of the kidney, it might be expected that a chronic process, or the extensive damage of an acute episode, would cause changes leading to renal failure. In 93 cases of uremic deaths studied at autopsy by Likely and his associates, pyelonephritis was the main renal pathologic finding in 32 cases (30 percent). Weiss and Parker state that chronic pyelonephritis with small kidneys usually terminates in uremia, and is responsible for renal failure more often than is chronic glomerulonephritis. They state that even unilateral chronic or healed pyelonephritis may set up a sequence of disastrous events, leading to death from uremia, as was the case in 4 of their 20 autopsies.

TREATMENT

Chemotherapy.—There have been many reports showing the favorable effect of sulfonamide therapy in pyelonephritis, and a thorough review of the literature on the use of chemotherapy in urinary tract infection has been made by Peterson and Finland (12).

Finland et al. (13) used sulfadiazine in 29 cases of pyelonephritis and cystitis, of which 17 were acute. Eleven patients had an excellent response, 5 had good recovery, and 1 had a relapse. However in 12 chronic cases only 1 patient had an excellent response, 1 had a good recovery, 7 were improved but had relapses, 3 received no benefit from the drug and 2 of these died. In eight of the refractory chronic cases sulfathiazole therapy was also tried with failure. Greene et al. (23) treated 42 patients with sulfadiazine for urinary tract infections, with 24 (57 percent) eventually showing a sterile urine, 12 (29 percent) showing improvement, but 4 (10 percent) complete failure.

The general experience has been that the response to chemotherapy in the chronic cases is poor, especially if there are complications such as renal calculus, stricture, tumor or other lesion. Regarding the toxicity of sulfadiazine, which seems to be the drug of choice, Satterthwaite (24) has treated 500 consecutive nonvenereal urologic patients (300 hospitalized and 200 ambulatory) with sulfadiazine. In this group 11.6 percent showed reactions of vari-

ous types, as compared to 29.6 percent reactions in 300 comparable patients treated with sulfathiazole.

The use of sulfamerazine, because of its theoretic promise of fewer urinary complications, has led to conflicting clinical reports. The few reported cases of pyelonephritis treated by penicillin do not furnish enough data upon which to judge the efficacy of the drug.

Nephrectomy and hypertension.—There have been at least 75 case reports of cures of hypertension following nephrectomy for unilateral renal disease, and in 48 of these (64 percent) chronic pyelonephritis was found (25). Goldblatt (26) states that at least 25 cases were reported to him personally in which removal of an infected kidney, usually for chronic pyelonephritis, was associated with the return to normalcy of a previously elevated blood pressure, and the pressure had remained normal for periods ranging from 3 months to 2½ years. Braasch et al. believe from a follow-up study of 198 patients that hypertension will be relieved in 70 percent of patients in whom it is accompanied by atrophic pyelonephritis, if the infected kidney is removed.

Crabtree and Chaset, from their series of 150 nephrectomies for unilateral renal disease, state that following nephrectomy there was no appreciable reduction in blood pressure. Sensenbach (25) points out that only 5 of the 75 reported "cures" of hypertension by nephrectomy meet the requirements for cure, that is, 2-year follow-up without return of hypertension. Goldblatt and his coworkers (26), on the basis of experimental work, caution against the expectation of relieving hypertension by nephrectomy in human cases of unilateral renal disease. From the work of Wilson and Byrom it might be postulated that by the time hypertension is recognized clinically there would be enough vascular damage to the nonpyelonephritic kidney to cause persistence of the hypertension despite removal of the infected kidney.

Relief of obstruction.—The role of obstruction to urinary flow in the production of pyelonephritis has been well illustrated experimentally (4). Human pyelonephritis due to obstruction is stated by Bell (7) to be 12 times as frequent as unobstructed pyelonephritis, but his figures are by far the highest. Gibson (27) reported 72 cases of unobstructive pyelonephritis and 42 cases with obstruction to urinary flow. Of the 32 autopsied cases of pyelonephritis terminating in uremia, 22 reported by Likely et al. showed no evidence of urinary obstruction.

Obviously the best approach to the problem is the relief of urinary obstruction by appropriate surgical intervention. Ballenger and his associates (28) have emphasized the importance of

protected foci, such as prostatic abscess, urethral stricture, and areas of salpingitis, as sources of infection and as the chief causes of failure in the treatment of chronic urinary infections, and surgical treatment of these also is advised.

Renal failure.—Ordinarily the onset of renal failure, giving rise to nitrogen retention and acidosis, is regarded as giving an ominous prognosis. However there is wide fluctuation in the course of pyelonephritis and there may be adequate kidney function for years after an episode of coma (1). For that reason the treatment of nephritis recently suggested by Thorn (29) would seem most appropriate to the renal failure of pyelonephritic origin.

Hypertension.—None of the various kidney studies has as yet furnished us with an antipressor substance, and the literature is still equivocal on the use of thiocyanate therapy with recent emphasis on the toxicity of the drug. The status of various types of sympathectomy also is equivocal. Flaxman (30) after a 10-year study of hypertension and an analysis of the results of the medical treatment of 244 patients, states that the mortality is about the same (31 percent) as that reported by Peet et al. (30.5 percent) in 350 comparable patients treated by splanchnicectomy and sympathetic ganglionectomy. Orthodox measures such as rest, sedation, limitation of activities, weight reduction, and psychotherapy appear to offer as much relief as the more drastic surgical procedures.

CASE REPORTS

Case 1.—A Wave hospital apprentice, first class, 21 years old, was brought to the hospital by ambulance. For some hours she had been complaining of severe pain in the right side of her abdomen. The pain radiated to the right flank and lumbar region, had been initiated by two episodes of nausea and vomiting, and was accompanied by slight urinary frequency.

Physical examination failed to disclose any abnormality except an old healed incision scar in the right lower quadrant of the abdomen. The patient's temperature was 100° F., pulse rate 82, respirations 20 per minute, hemoglobin 13 gm., and leukocyte count 15,200 per cu. mm. of blood. The urinary sediment was normal. The patient was thought to be hysterical because of her complaint of severe pain in the absence of physical findings. A neuro-psychiatric consultant believed the condition to be an acute emotional upset.

On the second hospital day the temperature rose to 101° Fahrenheit. Gynecologic examination failed to disclose any pertinent finding. The urine showed a trace of albumin and from 12 to 15 leukocytes per high-power field. The diagnosis was changed to pyelitis, acute, right, and after 5 days of symptomatic treatment the patient was discharged to duty.

This case probably represents a slight interstitial involvement of the right kidney, with later progression of the inflammatory process into the tubules to give rise to the diagnostic pyuria.

Case 2.—An apprentice seaman, 26 years old, entered the sickbay because of cough, chills, sweats, and fever of 1 day's duration. The temperature was 103° F., pulse rate 98, and respirations 22 per minute. There were a few coarse rhonchi throughout both lung fields. He was admitted to the ward with a diagnosis of catarrhal fever, acute. Within a few hours he complained of bilateral flank pain and dysuria, and physical examination revealed some tenderness to percussion over both kidney areas. The leukocyte count was 12,800, and the urinary sediment was loaded with leukocytes.

The patient was transferred to a Naval hospital where he was placed on sulfadiazine therapy. There was decreasing pyuria for 7 days, and the patient was discharged asymptomatic, with a normal urinary sediment, 2 weeks after entry.

This was a fairly mild attack of acute pyelonephritis which responded well to chemotherapy.

Case 3.—An apprentice seaman, 23 years old, entered the sickbay because of sore throat, fever, and a slight cough of 2 days' duration. The temperature was 102° F., pulse rate 100, and respirations 24 per minute. Examination showed multiple patches of follicular exudate on both tonsils, and a tentative diagnosis of bilateral follicular tonsillitis was made.

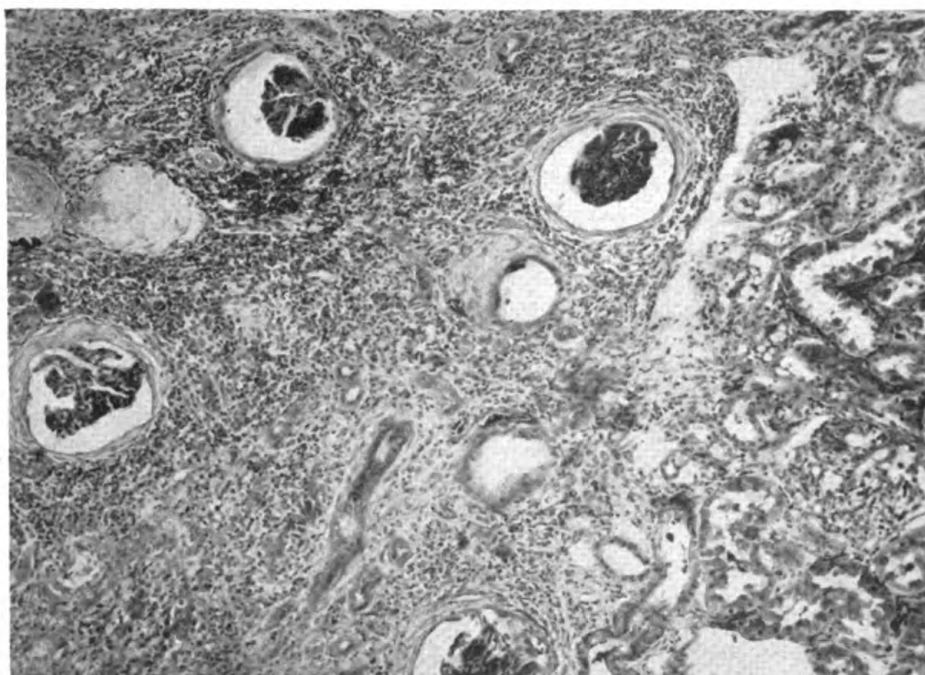
Throat culture taken on the second day showed the growth of a pure culture of β hemolytic streptococcus. Upon symptomatic treatment the sore throat was relieved and the temperature, pulse, and respirations were relatively normal on the third hospital day.

On the fifth hospital day the patient complained of mild constant right flank pain and the temperature rose to 101° Fahrenheit. Physical examination showed right costovertebral-angle tenderness and acute pain upon percussion over the right kidney region. The urine showed a trace of albumin and leukocytes "too many to count" per high-power field. The patient was placed on sulfathiazole therapy and was asymptomatic on the seventh hospital day, but his urine still showed many leukocytes. These gradually decreased so that the urinary sediment was negative 10 days after onset of urinary symptoms, and the patient was discharged well 4 days later.

Acute pyelonephritis occurring a few days after an acute tonsillitis suggests the latter as a focus for the hematogenous dissemination of bacteria and their lodging in the interstitial renal tissues.

Case 4.—A yeoman, third class, 20 years old, entered the sickbay with left flank pain and the statement that it was "another attack of pus kidney." A year previously he had had a similar attack with sweats and fever and was treated by a physician with "lots of sulfa pills" every day for 3 weeks. Then he noticed "dark" urine of decreasing amounts, had severe back pain, and got "sleepy." The physician stopped the sulfonamide medication, gave him sodium bicarbonate, and made him drink "gallons of water." Within a few days the patient's urinary output had greatly increased, his symptoms disappeared, and at the end of a week his urine was normal. He was told that he was cured of a "pus kidney" and to be careful in taking sulfonamides thereafter.

Upon admission here the patient's blood pressure was 110/78, the temperature 101° F., pulse rate 94, and respirations 18 per minute. There was considerable tenderness over the left kidney region and slight tenderness over the right. The urine showed a few erythrocytes and hyaline casts, but was



2. Case 5. Pyelonephritic scar, left, with fibrosis of some glomeruli, periglomerular fibrosis of others, destruction of tubules, and infiltration with fibrous tissue and lymphocytes. Normal kidney parenchyma, right, x 150.

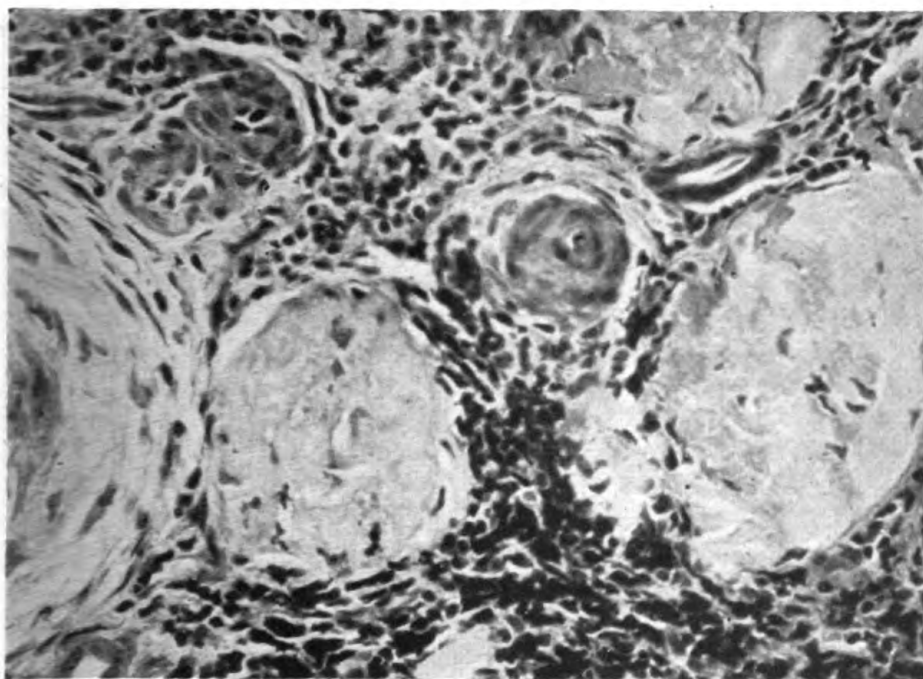
"loaded with leukocytes." The leukocyte count was 14,000; the blood urea nitrogen 28 mg. per 100 cubic centimeters of blood.

The patient was treated symptomatically for 2 days with no response and was then given 3 gm. of sulfadiazine a day. Within 3 days the symptoms had disappeared and after 7 days of sulfadiazine therapy the patient was asymptomatic and the urine normal. The patient was discharged to duty after intravenous pyelography revealed no evidence of urinary tract disease.

This patient had a second attack of acute pyelonephritis within a year. From his history he would seem to have survived one of the complications of sulfonamide therapy—precipitation of sulfonamide crystals in the urinary tract with resulting renal decompensation, which in this case was still reversible.

Case 5.—A 26-year-old veteran of World War II entered a Naval hospital complaining of severe left flank pain of 2 weeks' duration. The patient had had a similar episode 6 years before entry, was operated upon, and an aberrant vessel obstructing the ureter was ligated and excised. Two years prior to entry he was discharged from the Army because of hypertension and hydronephrosis. Eight months before admission the patient had left flank pain, hematuria, and fever. He was operated upon, and a perinephric abscess was drained. He was active and well until 2 weeks preceding entrance to the hospital when he experienced left flank pain and fever. Symptoms persisted and were of such intensity that the patient entered the hospital to have the kidney removed.

Examination showed a normal temperature, pulse rate, respirations, hemoglobin determination, erythrocytic, leukocytic, and differential blood counts.



3. Case 5. A hyperplastic arteriole (left, center) in a pyelonephritic scar. Lumen narrowed to the diameter of the erythrocyte in its center, x 650.

The blood urea nitrogen was 15.5 milligrams. Result of a Kahn test was negative. The urine showed a small amount of albumin, and a concentrated sediment showed leukocytes "too numerous to count." Phenolsulfonphthalein excretion from both kidneys was 85 percent in 1 hour. Cystoscopy revealed an inflamed bladder, clear urine from the right and cloudy urine from the left ureter, and culture of the latter showed *Staphylococcus aureus*. Intravenous pyelography was interpreted as demonstrating hydronephrosis of the left kidney with obstruction at the ureteropelvic junction. The right upper urinary tract was normal. The patient was given sulfadiazine for 5 days and a left nephrectomy was performed.

Pathologic report.—The kidney removed weighed 88 grams. The capsule was stripped with some difficulty to disclose a pale brown, slightly granular surface with foci of hemorrhage scattered throughout the cortex. There was a square scarred area in the cortex 2.5 cm. wide. The kidney cut easily to reveal a poorly defined, thin cortex, 0.3 or 0.4 cm. in width, with a small medulla. There was dilatation of the calices and an increase of fat about the pyramids. The mucosa of the pelvis and calices was hemorrhagic, but inflammatory exudate, stone, or stricture was not present, nor was there any obstruction of the ureteropelvic junction. About 1 cm. of ureter with the specimen was smooth, grey, glistening and apparently normal.

Microscopically there were scattered areas of cellular infiltration and scar formation throughout the cortex and medulla, some sharply circumscribed, others extending in radial striae from the cortex to the pelvis. In these areas there were many glomeruli, some completely fibrosed, some with periglomerular concentric fibrosis, some surrounded by lymphocytes and the remainder intact. The tubules in these areas were for the most part destroyed or atrophic with flattened epithelium, some showed a homogeneous pink substance filling the lumen (colloid casts), and others were intact and dilated. The

interstitial tissue showed an infiltration of mononuclear cells, mostly lymphocytes, and much fibrosis (fig. 2).

The pelvis had considerable increase of fibrous tissue, a heavy infiltration of plasma cells with a few lymphocytes and eosinophils, and much congestion and submucosal hemorrhage. In the involved areas the arterioles were prominent, increased in number, and showed moderate to severe hyperplastic sclerosis. Some were the seat of complete thrombosis and others had only a very small lumen because of the "onion peel" type of concentric proliferation of cells (fig. 3). These vascular changes were most prominent in sections taken from the large cortical scar but occurred throughout the inflamed areas.

The arteries were normal, as was the nonscarred tissue, except for the arterioles, many of which showed slight hyperplastic arteriolar sclerosis but in no way comparable to the changes seen in the vessels of the scarred areas. The pathologic changes were consistent with those of a healed pyelonephritis (diffuse) with hyperplastic arteriolar sclerosis.

Upon discharge from the Army in 1942 the patient was told that his blood pressure was 150/110. Daily blood pressures taken for 6 weeks in 1943 showed average levels of 157/107. Thiocyanate therapy for about 14 months did not affect the hypertension. Upon admission to a Naval hospital in May 1944 the readings were 170/120. Just prior to the administration of anesthesia, after preoperative sedation with morphine, the level was 170/90. Three weeks postoperatively the pressure was 140/100, with the patient ambulatory.

This case is an excellent example of the association of hypertension with a pyelonephritis that causes vascular scarring. The course of the patient's hypertension after his nephrectomy should prove of interest.

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REPLANTATION OF TEETH

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Replantation is the reinsertion of a tooth in its original socket from which it has been dislodged either by accident or design. The literature on this subject from the earliest reports of Ambroise Paré in the sixteenth century to the present, is very meager. Although replantation is probably the second earliest type of dental service, and has been practiced in a variety of circumstances for centuries, it has fallen almost entirely into disuse.

In the seventeenth and eighteenth centuries there were reports of numerous replantation attempts; most, however, were failures or at best lasted a maximum of 2 years. As more became known about the teeth and their supporting structures, and especially about aseptic procedures, the reports of successful replantations increased; since 1875 few unsuccessful cases have been recorded. Despite the number of successes, however, less and less replantation was done as dentistry improved the technic of artificial restorations. In the past 15 years there have been few reports on the subject and most of these are British.

Today, however, replantation may save many teeth that would otherwise be doomed because of lack of prosthetic facilities in certain war areas. Even in zones where prosthetic service is readily available, immediate replantation may be the treatment of choice. The technic is comparatively simple, even under most adverse conditions. Furthermore the successful replantation of a tooth is more satisfactory in some respects than any prosthetic replacement.

Technics described in recent reports are basically the same, varying only in management of the individual steps. For example, different technics are used in the cleansing of the dislodged tooth. Some of these include immersion of the tooth for 15 minutes at 100° F. in a 1:500 solution of bichloride of mercury, washing in normal saline solution, washing under plain tap water, and washing with alcohol.

Various materials which have been used to fill the root canal are copper amalgam, synthetic porcelain, guttapercha, and guttapercha with gold points introduced through the apical foramen. Once the tooth has been replanted, the methods that have been recommended for immobilization are cast metal splints, wire ligatures and gold or platinum bands. Marston (1), however, states

that immobilization by artificial means is not necessary when only one tooth is involved.

TECHNIC

The following technics have been used by the author and are advocated for the replantation of single-rooted teeth.

Replantation without devitalization.—No anesthetic is necessary. The dislodged tooth is washed under clean running water and carefully wiped with 70-percent alcohol. The socket is cleansed of its blood clot and irrigated with warm saline solution, and the tooth is immediately replanted, but only to a point 2 mm. short of its original position in the socket. This is done in the hope that the small blood clot at the apex will form the scaffolding for the new blood vessels and nerves which will rejoin those of the tooth.

The adjacent teeth are thoroughly dried by means of alcohol and air syringe. A large, loose mix of crown and bridge cement is then applied and allowed to flow over the labial and lingual surfaces of the replanted tooth and one or two teeth on either side, working the cement interproximally. As the cement begins to harden, it becomes possible to build it up to a thickness varying from 2 to 4 millimeters. This thickness is required for adequate strength and is easily tolerated by the patient.

The splint and tooth must be protected from the stresses of mastication. It is usually necessary, therefore, to open the bite by applying small blocks of cement about 2 mm. thick on the occlusal surfaces of the lower posterior teeth. The splint will last from 3 to 5 weeks, the period necessary for immobilization of the tooth. If for any reason the splint becomes dislodged, however, it should be replaced immediately.

After 5 weeks the splint and the cement blocks on the occlusal surfaces of the molars are removed. The elongated incisal edge of the replanted tooth is then carefully ground down with a stone. Pulp vitality tests should be made after 6 or 8 weeks, after 8 or 10 months, and then every 6 months. Roentgenograms should be taken periodically to determine the progress of bone formation.

Replantation after devitalization.—The technic of replantation of the tooth which is first devitalized is similar to the one just described. After the socket has been cleansed of the blood clot, it is plugged with sterile gauze covered with sulfanilamide powder. The tooth is washed under tap water, wiped with alcohol, and while it is held in a sterile gauze sponge saturated with normal saline solution, the root canal is opened and its contents removed. The canal is flushed with phenol and alcohol solutions, dried, and

filled with chloropercha and guttapercha points well condensed. The excess from the apical end is burnished smooth with a hot instrument. After the tooth has been examined to make sure that there are no calcific deposits adhering, the gauze pack is removed from the socket, and the tooth dusted with sulfanilamide powder, and inserted *completely* into the socket. The splinting technic is the same as previously described. Follow-up roentgenograms should be taken frequently.

It is impossible to describe a technic which would apply to all cases of replantation. The judgment of the operator is most important in the handling of cases in which the alveolus has been sprung or fractured, or where the bite is such that the position and form of the cement splint must be varied. If interproximal caries is found on the dislodged tooth, a filling should be placed before replantation.

PROGNOSIS

The literature contains reports of cases in which replanted teeth have remained in place for from 3 to 17 years. Maley (2) successfully replanted a posterior tooth which had straight roots. As a routine procedure he extracts a tooth in order to do root canal work on it. He reports replantations which lasted 9 and 10 years. Pincus (3) reports a 10-year satisfactory result.

Anslow (4) treats all incisors with apical involvement by first carefully extracting the tooth, curetting the infected area in the bone, filling the canal while the tooth is out of the mouth and, before replanting, doing the apicoectomy. Tilley (5) performs the apicoectomy after the tooth has been replanted and splinted, and finds that the age of the patient is a negligible factor if the tone of the gingiva is good and other conditions are favorable. John Hunter (6) as long ago as 1784 found that the taking of mercury by the patient, even if the gums were not affected at the time, was one of the unfavorable conditions.

Bodecker and Lefkowitz (7) report that the shorter the interval between extraction and replantation, the better the chances for the reattachment of the tooth. They caution against overlong immobilization of the replanted tooth.

There is some question as to whether a normal, vital, dislodged tooth may be replanted successfully without doing root canal therapy. Many agree that devitalization is not the best therapy. Taft (8) wrote in 1881, "In every instance in which a healthy tooth in a healthy person is replaced, immediate and permanent union may be expected."

Kaletsky (9) reports the case of a woman 30 years of age whose

four upper anterior teeth were dislodged in an accident. The teeth were replanted and immobilized by wiring and became firmly attached in 6 weeks. The patient was then told to return to her dentist to have root canal work done, since these teeth gave no response to tests for vitality. Fortunately the patient did not carry out this suggestion and returned after 6 months, at which time the teeth tested vital. Plans for filling the canals were indefinitely postponed, and in the 12 years that the case was followed pulp tests showed the teeth to be vital. X-rays disclosed no evidence of pathosis. Directly after the accident there was a deep bluish discoloration of the crowns, probably caused by internal hemorrhage. This discoloration completely disappeared after several years and the crowns showed only a slight yellow discoloration. These teeth remained in the mouth for 13 years before the first signs of root resorption manifested themselves, and then simultaneously in all four teeth.

Kaletsky (10) contends that in cases of severe trauma the dentist frequently acts too hastily when he immediately removes the root canal contents because the tooth shows discoloration. In such teeth, however, it is of greatest importance to do periodic pulp vitality tests, bearing in mind that for a short time after the injury the pulp response may be abnormal, but within several months it should return to normal. This conservative treatment in no way precludes extirpation of the pulp, should this later prove necessary.

No report was found in which the replanted teeth in humans were sectioned for study when finally lost. However Wilkinson (11), on sectioning the experimentally replanted teeth and supporting bone in a monkey, found that the teeth became reattached by ordinary scar tissue, markedly simulating normal peridental membrane. This was true even in one tooth when the peridental membrane had been completely removed before the tooth was inserted in its socket. The replants, with or without peridental membrane, could hardly be distinguished in section. It must be kept in mind, however, that this finding may not apply in humans.

In all reports on replantation, from that of John Hunter to the present day, the importance of preserving the peridental membrane has been emphasized. As no study of the histopathology of replanted teeth in humans has been recorded, however, any discussion of this aspect is purely speculative.

There can be no disagreement that the peridental membrane is torn during extraction, and that some of it obviously remains on the tooth in little islands. These islands of peridental membrane are of great importance, for they form the new layers of cementum or osteoid tissue which are essential and within which the loose



1. Case 1. X-ray film taken 4 months after replantation, showing position of the apices just short of the base of the sockets. Evidence of new bone formation is desirable.



2. X-ray film of the same case taken 5 months after replantation. Osseous deposition at base of sockets is progressing satisfactorily.

ends of the fibers of the membrane remaining in the socket will be calcified and so reattach the tooth. In experiments on human teeth where the root was completely denuded of its peridental membrane, reattachment did not take place. These teeth merely acted as a foreign body. Kaletsky (12) has tried this technic on two cases without success.

The failure of the completely denuded root to reattach itself and the fact that the chances of reattachment increase as the time interval between extraction and replantation is shortened, point directly to the importance of the preservation of the peridental membrane. In any technic, therefore, it is obvious that great care should be taken that the peridental membrane on the dislodged tooth will not be further damaged.

CASE REPORTS

Case 1.—A patient, 25 years old, reported about 1 hour following the accidental loss of the four lower anterior incisors. The teeth themselves were uninjured, and a careful examination of the alveolar bone showed no apparent fracture. The gingival tissues appeared normal and a fairly good blood clot had already formed in the four sockets. The patient, though much disturbed by the loss of the teeth, was free from pain. The teeth were washed under running tap water and wiped with 70-percent alcohol. The sockets were cleansed of their clotted blood and irrigated with warm saline solution, and the teeth were inserted into their respective sockets to within 2 mm. of the bottom. No anesthetic was necessary.

To protect the newly replanted teeth, soft crown and bridge cement was flowed and built up over the carefully dried lingual, labial, and interproximal surfaces, until a splint approximately 3 mm. in thickness was formed on the middle third of the crowns of the replanted teeth and the two adjacent teeth. Another mix of cement was prepared and flowed carefully over the occlusal surfaces of the lower right and left first molars until a block was formed about 2 or 3 mm. thick. These blocks were sufficiently thick to keep the bite open just enough to free the replanted teeth completely from the stress of mastication.

After 3 weeks the cement splint was removed from the anterior teeth and they were found sufficiently firm to make further splinting unnecessary. Two weeks later the cement blocks on the molars were removed and a normal functioning bite was re-established. At this time the teeth were very firm in their sockets; there was no discoloration or pain, and the gingivae were pink and firm. The incisal edges of the teeth were ground down to compensate for the elongation which was artificially produced at the time of replantation.

For 3 months the x-ray appearance was normal. The surrounding gingival tissues were healthy and the patient experienced no discomfort. In the fourth month, however, x-ray examination showed slightly rarefied areas around the apices. These areas continued to enlarge slowly during the fifth month, and it was decided to extract the teeth.

From further study of replantation it is now believed that this course of action was premature and probably unnecessary. No difficulty was experienced in the removal of these teeth and no ankylosis was apparent. The teeth were not sectioned, but judging from the normal way in which they came out, it is most probable that tissue reattachment closely simulating peridental membrane attachment was present.

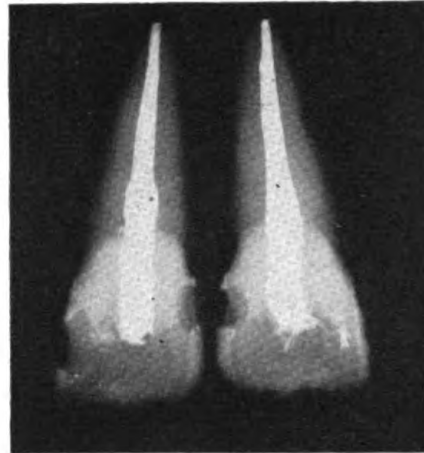
Case 2.—A 20-year-old seaman, first class, reported about an hour after an accident had completely dislodged the upper central incisors, fractured the crown of the right lateral incisor, and loosened the left lateral incisor. He brought the dislodged centrals with him. There was a well-formed blood clot in each socket. Clinical and x-ray examinations of the teeth and alveolar bone showed that they had not been injured. The sockets were cleansed of their blood clots and plugged with sterile gauze dipped into sulfanilamide powder.

The teeth were washed as in the previous case, and root canals filled. The teeth were then eased into their sockets until completely seated. The loosened left lateral incisor, in which a root canal filling had been placed previous to the accident, was also seated completely. The right slightly loose lateral incisor, the crown of which had been fractured, was not devitalized at this time.

The teeth were thoroughly dried and a thick splint of soft cement was flowed over the labial and palatal surfaces from cuspid to cuspid and well into the interproximal spaces. As in all cases, the exact position of the cement splint on the teeth had to be determined by the bite, which in this case was protrusive, with the lower anteriors in labioversion to the upper. It was not necessary to keep the bite open with cement blocks on the lower molar occlusal surfaces, inasmuch as there was no contact between the splint and the opposing teeth in function occlusion.



3. a. Case 2. Alveolar bone before replantation; no bone fracture present.



b. Teeth outside the mouth after root canal filling with dense guttapercha.



c. Replanted teeth completely seated in sockets. The loosened left lateral incisor, previously filled, was also seated completely.



d. Cement splint over teeth. Note position over middle third of crown and extension to adjacent teeth.

The patient was given daily 20-minute infra-red-ray exposures in the area of operation. Four weeks after replanting, the splint was removed. The teeth had become firmly reattached and the gingival tissues appeared normal. At no time did the patient complain of pain.

Final roentgenograms were taken 10 weeks after the teeth were replanted, revealing a radiolucent area around the apex of the fractured right lateral incisor. There was no discoloration of the teeth, and the gingival tissues appeared normal.



4. Case 2. X-ray film taken 1 month later. Splint removed. There is an area of rarefaction around the apex of No. 7, the crown of which was fractured. The root canal of No. 10 was filled prior to the accident.

COMMENT

Although only two reports of replantation on servicemen are to be found in the literature, this is a most valuable type of dental service in wartime, and the cases reported in the literature show that good results can be obtained with a very simple technic. With the tooth outside the mouth, sterilization of the root canal can be readily achieved and a very well condensed filling placed. This is done at a time when the germicidal permeability of the root dentine is greatest (13). Complete eradication of infection is essential to the success of any root canal operation.

It has been the experience of many investigators that the roots of replanted teeth ultimately will show noticeable resorption, sometimes as early as 3 years after replantation. For this reason the extraction and replantation of a tooth for the sole purpose of insertion of a root canal filling is not considered justified. The numerous successful cases of root canal therapy done on teeth in situ would make the latter technic by far the one of choice.

Finally, and of great importance, is the follow-up of these cases for as long as possible. Only in this way can the method be improved. Follow-up is not much more difficult when the work is done on a serviceman subject to quick transfer than on a patient in private practice. The serviceman may be given a letter requesting that check x-ray films be made and mailed back by any dental officer he may contact. The patient is told at what intervals to

have x-ray studies made and also to write regarding subjective symptoms as he notices them.

CONCLUSIONS

1. Replantation of dislodged anterior teeth can be done simply, painlessly and quickly, with favorable prognosis.
2. The root canal of a tooth which is outside the mouth can be sterilized and filled easily.
3. Splinting or wiring of the tooth need only be maintained for from 3 to 5 weeks. The cement splint as described is simple and adequate. Stability is quickly restored.
4. If the tooth is not devitalized before replantation, periodic check-ups by x-ray and vitality tests should be made. Should there be unfavorable developments, such as putrescence or pain, the tooth can be devitalized.
5. The shorter the time between dislodgment and replantation, the better the chances for reattachment of the tooth.
6. No artificial replacement of a lost anterior tooth restores the appearance and function so well as does the replantation of the natural tooth.
7. Replantation of an anterior tooth for a serviceman is practical and often essential for both dental and psychologic rehabilitation.

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SIMPLE TECHNIC FOR SIMPLE FRACTURES OF MANDIBLE

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Many technics have been utilized in the reduction of simple fractures of the jaws in the past few years. However the cardinal requirements for a satisfactory result are still (1) proper reduction; (2) retention of the fragments in position until union is assured; and (3) supportive treatment, including proper diet, drug therapy, and maintenance of oral hygiene. During the past 10 years the trend has been toward elastic traction or rigid extra-oral fixation, although there are occasions when there is no alternative but intra-oral rigid wiring or application of the cast splint.

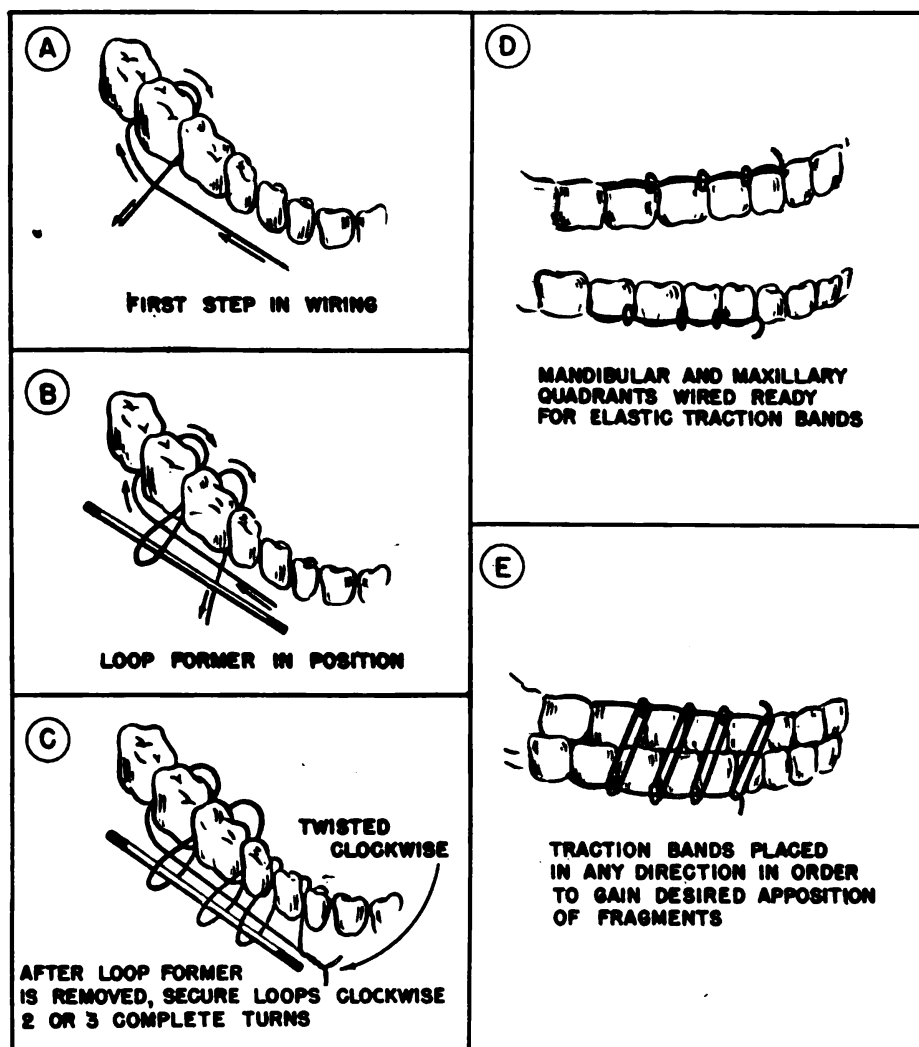
The management of jaw fractures at sea must include provision for the possibility of vomiting due to seasickness, for unless the patient is able to open his jaws when necessary, the aspiration of vomitus could result in very undesirable or fatal consequences. Under such conditions the cardinal principles of proper reduction, sustained retention, and adequate supportive treatment may become difficult problems.

There are several technics, however, which fulfill the requirements:

1. Rigid extra-oral fixation. (The Stader appliance allows for adequate function of the dental arches while under treatment.)
2. Elastic traction, intra-oral and extra-oral. (Patient must be instructed how to remove elastics in case of an emergency.)
3. Cast splints with removable pins. (Patient should again be instructed as to proper relief if necessary.)
4. Some type of modified Barton bandage. (Elastics may be cut or removed when occasion demands.)

A simple efficient method for employing elastic traction for use in either the field or hospital is described here. The technic entails continuous wiring in the buccal areas of each arch, forming loops to which intermaxillary elastics are attached.

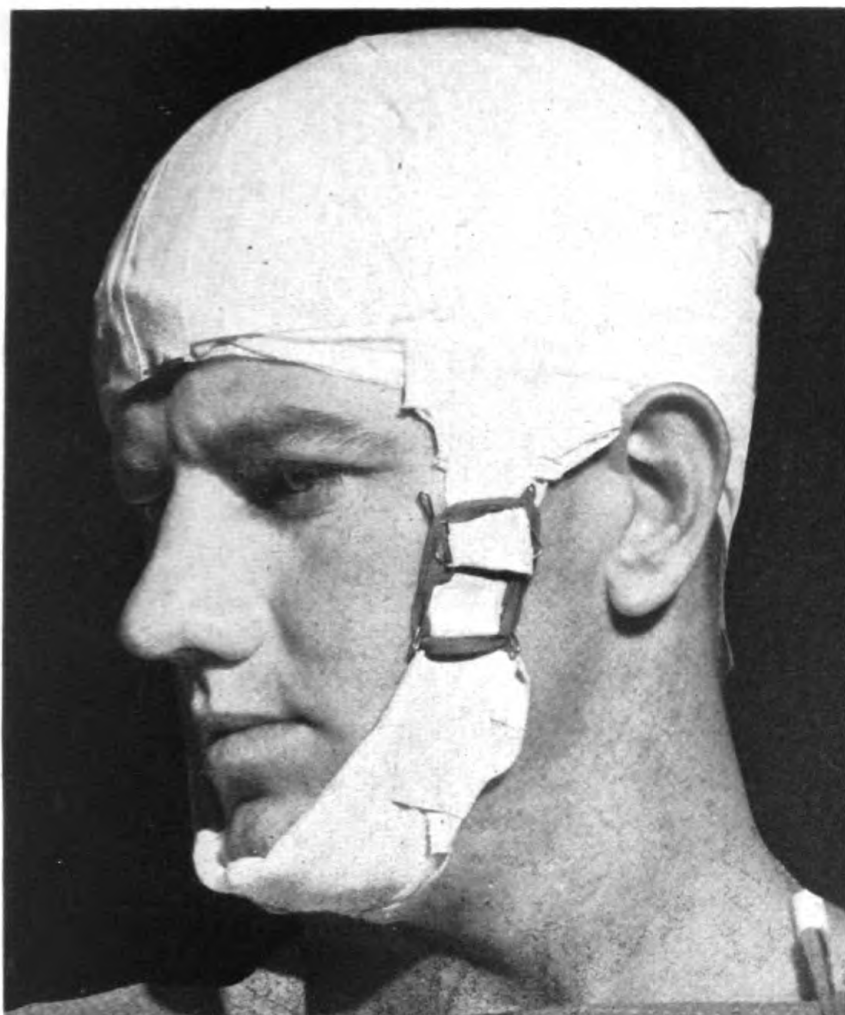
Wiring is started as shown in figure 1A, distal to the posterior tooth to be included, leaving a strand of wire for final anterior twisting (fig. 1C). The loops are formed by passing the threading end of the wire around the lingual, through the interproximal and under the buccal strand of wire and loop former, then back through the same interproximal space (fig. 1B). (The loop for-



1. Diagrammatic sketch illustrating wiring technic. See text.

mer is a piece of thick lead wire or dental bur.) The process is repeated around each tooth until the required number of loops are formed, after which the two free ends are secured in the cuspid area by twisting clockwise. The loop former is easily removed by withdrawing to the anterior. All loops are then firmly secured by twisting clockwise two or three full turns and bending gingivally for proper retention of the elastic bands.

Complicated fractures may require supplementary procedures such as the modified Barton bandage shown in figure 2, which is prepared as follows. After a regular Barton bandage is applied a 2-inch section between the temporal region and the chin is cut away from one side. Two ordinary paper clips that have been bent to form lugs (fig. 2) are secured to each end of the bandage with adhesive tape and elastic bands are applied. The opposite side of the face is then treated in the same manner.



2. Modified Barton bandage, lateral view, showing use of extra-oral traction.

The following case report is that of a patient with a simple fracture through the neck of the right condyle and a comminuted fracture of the right side of the mandible extending from the bicuspid area to an area just lateral to the mental process.

Case report.—A ship's cook, aged 21 years, had been hit on the right side of the face by a baseball. He complained of pain on movement of the jaw, malalignment of the teeth, and hemorrhage from the mouth. Examination revealed an edema of the right submandibular region as well as edema just below the temporomandibular joint. A depressed fracture with a distal fragment displaced medially was palpated along the ramus at the level of the upper third. There was also rotation of the body of the mandible posterior to a palpable fracture extending from the second bicuspid to a point lateral to the mental process. The right lower molars were angled and pushed medially.

X-ray examination revealed a simple fracture of the right ramus along the upper one-third, and a comminuted fracture of the body of the mandible in the region of the right bicuspid (fig. 3).

Treatment was begun by wiring the upper and lower dental arches with



3. X-ray film showing fracture at neck of condyle and comminution in body of mandible.

continuous 18-gage rhodium-plated brass wire according to the technic described and illustrated. Intermaxillary elastic bands were applied, but it was evident that the desired apposition could not be attained by means of intra-oral elastic traction alone; at the inferior border of the mandible the lower portion of the proximal fragment was not in satisfactory position. The modified Barton bandage previously described was therefore applied. Postoperative care included sedation, maintenance of oral hygiene, and a high caloric diet. Bone phosphate in liquid form and vitamins were administered orally each day.

At the end of the first week there was no perceptible edema. On the twenty-first postoperative day the Barton bandage was removed. On the fiftieth day check films revealed satisfactory position and evidence of union. The elastic bands were then removed but the wire ligatures were left in place

until 7 days later when maintenance of position was assured. The patient was discharged to duty and examination on the seventieth postoperative day revealed normal dental occlusion, adequate function of the jaw, and a palpable callus formation at the area of the comminuted fracture. Four months following the injury the callus could not be palpated and function remained normal. X-ray examination showed that position was satisfactory.

SUMMARY

1. A practical means of treating simple fractures of the mandible under military conditions is discussed.
2. A case of simple comminuted fracture of the mandible treated by intra-oral elastic traction supplemented with the modified Barton bandage is presented.
3. Reduction and adequate fixation were accomplished by traction rather than by manipulation and rigid fixation.



DUMPING SYNDROME AFTER GASTRECTOMY

The dumping syndrome consists of profound nausea and weakness, a generalized unpleasant sense of warmth throughout the body, a cold diaphoresis of the face, particularly of the forehead, and cardiac palpitation. Occasionally there is hypermotility of the small bowel with borborygmus ending in explosive diarrhea. The attack usually lasts from 30 to 60 minutes and is frequently prevented or relieved if the patient assumes a supine position. The cause is believed to be the rapid emptying of the stomach after subtotal gastrectomy, producing sudden distention of the upper portion of the small bowel, which initiates a trigger mechanism producing a widespread enteric influence characterized by excessive peristaltic activity, borborygmus, and in severe cases by violent diarrhea. It is believed, moreover, that the development of this abnormal reflex is directly related to the size and type of gastroenteric anastomosis, particularly of the Polya type. It occurs in from 5 to 12 percent of gastric resection cases. When rapid dumping of food from the stomach into the unprepared jejunum has been once established it is apt to be permanent. The results of the operation which narrows the opening of the gastric remnant have been uniformly good; however the series is still too small to insist categorically that this solves the problem.—CUSTER, M. D., JR.; BUTT, H. R.; and WAUGH, J. M.: So-called dumping syndrome after subtotal gastrectomy; clinical study. *Ann. Surg.* (in press).

NEUROPSYCHIATRIC EXPERIENCES IN ADVANCE BASE UNIT

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Follow-up information in doubtful neuropsychiatric cases and evaluation of the results of "screening" procedures for Naval recruits are obtained with difficulty. A unique opportunity, however, to examine a group of men from the neuropsychiatric standpoint, to live with them, and to observe their subsequent course, resulted in calling attention to some psychiatric errors and pointed the way to more efficient detection and disposal of the psychiatrically unfit.

The experiences constituting the subject matter of this communication occurred while serving with an advance base unit during its organization, transportation overseas, and staging period at the advance area.

The group composing the unit was organized at a training center in the United States for the purpose of training for duty and transportation to an overseas base. The unit consisted mostly of technician ratings who were specialists in the various activities pertinent to an advance base.

Upon completion of the training period, the unit was shipped overseas to a staging area, where it remained several months. At this area many ratings were employed in various activities about the base. Of necessity much of the work was unrelated to the specialties in which the men were rated.

Finally the unit left this area and moved forward to establish its own advance base. When this had been done the original unit was formally dissolved, and the personnel remained as base personnel.

The following observations were made over the 9-month period in which the unit was in commission.

Procedures at the training center.—At the training center in the United States, each man assigned to the unit was given a physical and neuropsychiatric examination to determine his fitness for overseas duty. Notes were taken of the findings and of the impressions of the psychiatrist and these were filed for future reference. Thus when a patient was referred for consultation later on, it was possible to obtain the file and compare original

impressions with those obtained at consultation. The advantages of keeping this file were obvious; it served as a valuable check on patients' later statements of having had complaints of long standing, such as headache, enuresis, and "nervous trouble," and enabled the psychiatrist to observe his own sources of error.

The type of examination given was a brief (3 to 5 minutes) "screening" examination modeled on that developed by Wittson and his coworkers¹ at the United States Naval Training Station, Newport, Rhode Island. This was supplemented by return visits of persons whose fitness was doubtful. As much time as necessary was allotted to these return visits. As a result of this procedure, every patient examined was placed in one of the three following categories: (1) Rejected and transferred to a U. S. Naval Hospital; (2) accepted for overseas duty with a notation of "doubtful" on his file card, with findings; and (3) accepted for overseas duty with negative neuropsychiatric findings. Accordingly these three groups are referred to as "rejected," "doubtful," and "negative."

The following information was obtained in the "screening" examination: Name, rate, age, social status, married or single, church, years in school, history of headaches, dizzy or "faint" spells, convulsions, "nervous trouble," enuresis, somnambulism, stutter, arrests, alcoholism, head injuries, and serious physical illnesses, kind and duration of last civilian employment, presence of psychotic, psychoneurotic or "psychopathic" manifestations, and neuropathologic conditions.

During return visits of "doubtful" patients, any suggestion of neurologic or psychiatric tendencies obtained in the first interview was amplified and investigated.

Prophylactic procedures.—It was thought that the long voyage overseas, with its delays at anchor in various ports and the resulting inactivity, would provide a considerable morale problem and a strain on the unstable. This proved to be correct. In order to combat this condition, lectures were given to groups, mostly hospital corpsmen, on morale and its promotion. The points stressed were the desirability of the following: (1) Understanding and discussion of war aims; (2) awareness of the universality of fear in appropriate situations and of minor manifestations of "nervousness"; (3) cultivation of social insight and judgment; (4) a frank recognition and discussion of the problems of adjustment to discipline, to periods of inactivity, to crowding, to the uncertainties of the future, and to physical discomfort; (5) the

¹ WITTON, C. L.; HARRIS, H. I.; and HUNT, W. A.: Detection of neuropsychiatrically unfit. U. S. Nav. M. Bull. 40: 340-346, April 1942.

cultivation of all possible extracurricular activities or "hobbies;" (6) the acquisition of knowledge of one's environment and of facility in making specific adaptations to it.

In addition informal talks on subjects of general interest, designed to provide information and stimulate thought on "hobbies," world affairs, and the prospective environment, were given.

The result of these talks was difficult to evaluate, but many contacts with the men led to the belief that they were of considerable prophylactic value.

Consultation procedures.—On board ship, and at the staging area, medical officers were made aware of the facilities for neuropsychiatric consultation. Information concerning complaints and their immediate history was solicited from medical officers, divisional officers, and from shipmates of the men who were referred for consultation study. Upon request psychiatric examination was conducted according to standard practice, and the findings recorded. Finally reference was made to the patient's file card, and recommendations relative to disposition were communicated to the senior medical officer.

Treatment.—Treatment facilities were limited because of the lack of facilities for hospitalization and observation, the large case load from referrals, and the impossibility of establishing any routine times or places for treatment interviews.

Reassurance and constructive advice, or recommendation for transfer to a hospital was all that could be done in most cases. In some instances, however, more extended and repeated therapeutic interviews were carried on, aimed at emotional catharsis and the promotion of superficial insight. Deep psychotherapy was out of the question because of the short time available and the impossibility of any regularity or system.

Every man not transferred had to be considered satisfactory for duty within a few days. As a systematic therapeutic program of any magnitude could not be followed, a few patients were carried along with infrequent casual interviews, but the majority could be seen only two or three times.

Treatment of chronic borderline neurotics and unstable personalities consequently proved unsatisfactory under the circumstances. It is doubtful whether treatment of the chronic unstable and unfit can ever be adequate at advance bases—a potent reason for making every possible effort to "screen" these persons before they leave the continental United States. It is true that about two-thirds of the referral patients were handled successfully without the necessity of transfer. But these were mostly mild, acute, reactive types, easily yielding to simple measures. It is

believed, however, that more would have had to be transferred had no therapy been available.

TABLE 1.—*Distribution and disposal at training center*

Original category	No. examined	Percentage referred for consultation	Percentage to duty after consultation	Percentage transferred
Negative.....	964	3.52	2.38	1.14
Doubtful.....	84	21.4	17.84	3.57
Rejected.....	30			100

The figures shown in table 1 indicate that about two-thirds of all those men who had to be taken out of the unit for neuropsychiatric reasons within 9 months, were rejected at the training center. They also show that neuropsychiatric referrals were about seven times as frequent and transfers about three times as frequent among the "doubtfuls" as among the "negatives."

The marital status of the examinees is seen in table 2; figures representing the percentage of married or single in the group indicated are given.

TABLE 2.—*Marital status*

	Percentage of whole group	Percentage of training-center transfers	Percentage of referrals returned to duty	Percentage of referrals transferred	Percentage of total psychopathology seen
Married.....	28.3	44.8	55.2	50	50
Single.....	71.7	55.2	44.8	50	50

These figures show that the proportion of neuropsychiatric patients who were married was greatly in excess of the proportion of married men in the whole population. The age distribution is seen in table 3.

TABLE 3.—*Age distribution*

Age	Percentage of whole group	Percentage of training-center transfers	Percentage of referrals returned to duty	Percentage of referrals transferred	Percentage of total psychopathology seen
17-26.....	77.4	65.5	57.9	78.5	67.3
27-36.....	18.8	24.1	31.6	14.4	23.4
37-46.....	3.7	10.4	10.5	7.1	9.3
47-56.....	0.1	.....	.....	.....	.....

These figures indicate that the proportion of 17- to 26-year-olds in the total psychopathology group seen was less than their pro-

portion in the whole population; the reverse was true of the 37- to 46-year-olds.

Table 4 shows the diagnoses among the group "rejected" at the training center.

TABLE 4.—*Conditions causing rejection at training center*

Dementia praecox.....	1
Psychoneuroses.....	7
Constitutional psychopathic states.....	15
Posttraumatic personality disorders.....	4
Epilepsy.....	1
Enuresis.....	1
Stuttering.....	1
Total.....	30

The diagnoses of those patients transferred after shipping out are listed in table 5.

TABLE 5.—*Conditions causing rejection after leaving States*

Diagnoses	Original category	
	"Doubtful"	"Negative"
Dementia praecox.....	1	4
Psychoneuroses.....	0	1
Constitutional psychopathic states.....	1	3
Posttraumatic personality disorders.....	0	3
Psychosomatic problems.....	1	0
Totals.....	3	11

Tables 4 and 5 show the relative preponderance of various types of personality disorders (constitutional psychopathic states) as disabling psychiatric disabilities. Among the schizophrenics, two-thirds were completely missed at the examination for overseas service, a fact which suggests extreme difficulty in detecting them before regression sets in and the need for special care in the examination of "schizoid personalities."

Table 6 shows the diagnoses among those returned to duty after overseas referral for consultation.

TABLE 6.—*Conditions causing referral after leaving States*

Diagnosis	Original category	
	"Doubtful"	"Negative"
Psychoneuroses.....	1	3
Constitutional psychopathic states.....	9	11
Psychosomatic problems.....	1	0
Migraine.....	2	1
Posttraumatic personality disorders.....	1	0
Malingering.....	0	1
"Nonpsychiatric".....	1	7
Totals.....	15	23

From tables 2 to 6 it will be seen that of a total of 52 men who were referred for consultation after being shipped out, 8 were "nonpsychiatric," 1 was a malingerer, 14 were transferred, and 29 were returned to duty after simple therapeutic procedures. In other words, about two-thirds of the psychopathology found could be successfully treated by the simple methods described.

The patient with enuresis who was rejected at the training center was likewise found inadequate, immature, and unstable.

The case of "stuttering" rejection was so severe that the individual, at times of stress, could not, for minutes at a time, make himself understood.

Only four inverters came to the attention of the psychiatrist. One had been classified as "doubtful" in the United States; he adjusted after superficial therapy. Three had been undetected at the training center; one of these had to be transferred in an anxiety state, and two adjusted after superficial therapy. It is not to be supposed that the three who adjusted were "cured," but rather that they adapted to their situation, carried on with reasonable efficiency, and caused no trouble.

One of the men with posttraumatic personality disorders transferred after shipping out had received a head injury at the training center 10 days before leaving. He was without symptoms when he was shipped out.

One "doubtful" patient was transferred, with the diagnosis of constitutional psychopathic state, after leaving the United States. He displayed considerable anxiety and was inadequate. He was returned to duty from an overseas base hospital, the only one in the series so returned, just as the unit was dissolved. By the time he rejoined the unit his condition was exactly the same as before his transfer.

The patients listed as "nonpsychiatric" were mostly disciplinary problems, whose behavior could not be established as psychopathic, and who were reported to the referring officer as "administrative problems," as also were most of those with a diagnosis of constitutional psychopathic state.

COMMENT

In discussing the findings it is necessary to bear in mind the history of the unit; it was never at any time a front-line combat echelon and consequently the conditions reported had no relation to combat fatigue or combat trauma. On the other hand there was always the possibility of submarine or air attack, and there were long periods of inactivity, or of routine labor mostly unrelated to the specialized training of the persons involved.

Disregarding details concerning causative factors, and pending a thorough review of the case histories, it is possible to assign major importance to the following conditions: Constitutional predisposition; preexisting psychopathologic behavior patterns; separation from former relationships of emotional dependence; unstable business and domestic affairs at home; inadequate appreciation and understanding of war aims and of the mission and outlook of this particular unit; inadequate resources in the individual for sublimation, such as hobbies or study; an environment involving considerable physical discomfort; unconscious homosexual tensions arising from the protracted and inescapable intimacies in an exclusively male social body; and a general lack of social insight and judgment.

In view of the opinion frequently expressed that heterosexual deprivation, as such, is often of etiologic significance, it is interesting to note that this did not appear as a causal factor in any case observed. Moreover the majority of these men had not even spoken to a woman in 9 months.

Certainly the most productive means of attack on psychiatric disease in this type of unit is prophylaxis, both by adequate "screening" before shipping out and by efforts to minimize or forestall the effects of the aforementioned factors.

Regarding screening, there is one hazard which must be pointed out. Not infrequently division officers and others in authority over the men will protest against the medical officer's recommendation for rejection of a certain person, alleging that he is indispensable to the unit, or that "the Navy will make a man of him," or the like. Errors of this type have convinced the writer that better results are to be expected when reliance is placed upon expert rather than lay judgment. Once chronic psychopathosis of any magnitude appears, treatment at any activity short of a psychiatric hospital in the continental United States is useless. These people simply cannot adapt themselves to the exigencies of this kind of situation, and their presence as psychiatric cripples contributes to the instability and inefficiency of the entire unit. There is no prospect that treatment overseas will enable them to "pull their own weight." This opinion, however, does not apply to the acute neuroses of war. Persons with superficial, minor complaints that can be dealt with by reassurance and catharsis in a few interviews can be benefited considerably.

CLINICAL NOTES

PENILE RECONSTRUCTION AFTER TRAUMATIC FRACTURE

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Traumatic fracture of the corpora cavernosa without urethral damage is extremely uncommon even in this present tremendous conflict. When this injury occurs there is not only an anatomic and functional deformity of the penis but there is also an unfavorable psychologic influence, particularly on the young.

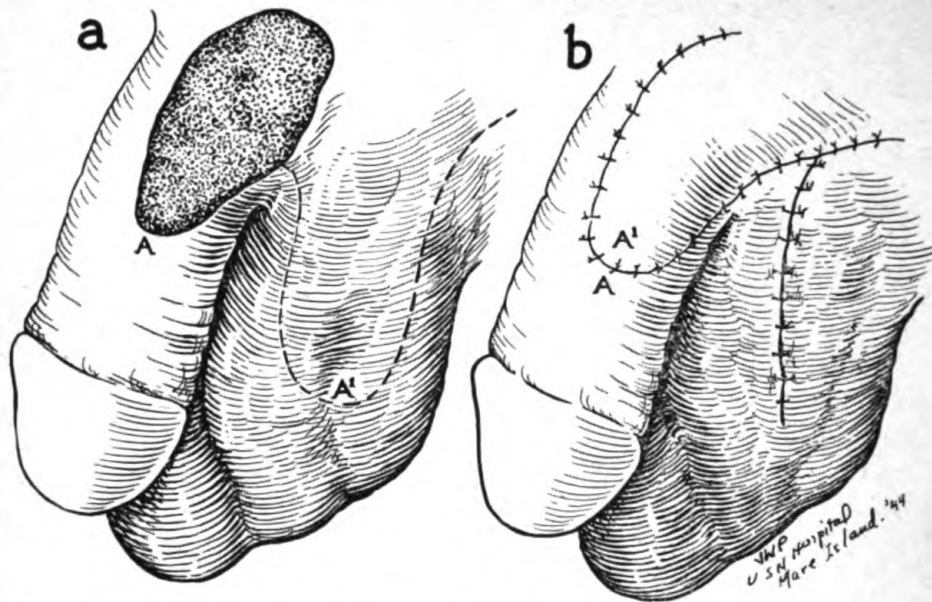
The major complaints of the patient whose case is presented here were (1) loss of the power of erection, (2) penile deformity, and (3) partial anesthesia of the glans penis.

Case report.—This man was injured by shell fragment. He sustained compound comminuted fractures of the lower extremities and extreme lacerations of the penis and scrotum. He was seen 1 hour after his injury. The penile injury consisted of a laceration of the shaft $\frac{1}{4}$ inch back of the corona on the right side, extending through the penis to $\frac{1}{2}$ inch from the pubic tubercle on the left side. The intervening tissue was necrotic, extending through the corpora cavernosa and involving the left spermatic cord. The urethra was not damaged. After the patient had been treated for shock, the lacerations were debrided and dusted with sulfanilamide powder and packed with vaseline strips. Infection developed in the wounds, with an increase in local tissue necrosis.

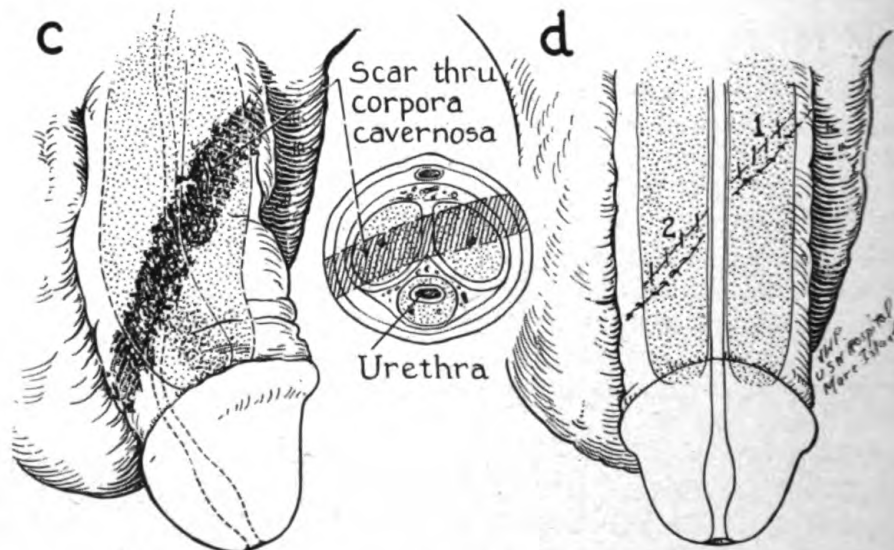
Treatment consisted in removal at the time of injury of the necrotic left testis and debridement of the penile wound. Three months later a secondary suture was accomplished and the wounds were closed satisfactorily. The patient was then evacuated, arriving at this facility 7 days later.

Examination of the penis and scrotum at this time revealed a through-and-through scar of the penile shaft beginning $\frac{1}{4}$ inch behind the corona on the right side and extending diagonally through the penis to the base on the left side. This scar, $\frac{3}{4}$ inch in diameter, was strongly attached and contracted. The left testis was absent, the penis was pulled to the left in a flaccid position, the glans was partially anesthetic, and the patient was unable to obtain an erection of the penis distal to the diagonal scar. There was a draining sinus in the left flank caused by a small foreign body.

The patient was prepared for operation and the penile scars on the left were excised (fig. 1a). A large cutaneous defect was consequently created on the left side at the base of the penis, which was closed by transposing a



1. (a) Excision of penile scar with transposed flap outlined on scrotum.
 (b) Postoperative picture showing the flap transposed to cover the penile defect and the wound edges approximated.



2. (c) Scar completely through corpora cavernosa showing penile distortion.
 (d) Complete excision of scar with reconstruction of the corpora cavernosa in two stages. Note the normal appearance of the penile shaft.

flap from the scrotum (fig. 1b). After complete recovery from this surgery the patient was given a leave of absence. On his return all of the induration had subsided, the wounds were well healed and the penis hung in the normal position.

At a second operation reconstruction of the corpora cavernosa was done (fig. 2c). This consisted of excision of the scar from the right side of the penis and accurate approximation of the corpus cavernosum (fig. 2d). Absolute

hemostasis had to be established. The patient stated he noticed the right side of the penis becoming firm on attempted erection shortly after surgery. A waiting period of 1 month was allowed and then the same type of reconstruction was done on the opposite side.

The penis was splinted for a period of 10 days with a compression bandage in order to prevent hematoma formation, to decrease swelling, and to immobilize the suture line. The compression bandage and all sutures were removed by the tenth day; healing occurred by primary union. Since then the patient states that whenever he has an erection the entire penile shaft functions.

SUMMARY

The important features about penile reconstruction are:

1. Replacement of any penile skin that is absent so that on complete erection the lack of covering material does not distort the organ.
2. Absolute hemostasis at the time of surgery in order to prevent hematoma.
3. Excision of all the existing scar and an accurate reposition of the corpora cavernosa so that a minimum of scar tissue is present at the new juncture.
4. A compression dressing postoperatively to reduce swelling, to prevent any hematoma, and to immobilize the suture line. If these procedures are carried out, primary union will result.



RECTAL EXAMINATION IN APPENDICITIS

Rectal examination should always be performed in suspected appendicitis. The patient is best examined in the left lateral position (Sims) as this tends to bring the appendix downward and over toward the palpating finger. In over 50 patients of patients with acute appendicitis, tenderness may be elicited high in the right vault of the pelvis. When located low down in the pelvis, the appendix itself may be palpated. The rectal examination is particularly valuable in children in whom the relatively shallow pelvis allows the examining finger to reach a much higher level than is possible in the rectal examination of adults. Bilateral tenderness from acute appendicitis is rare, but may occur if the appendix is located between the bladder or uterus and the rectum, if there is an appendiceal pelvic abscess, or if peritonitis is present. Careful examination of all the other organs rectally palpable should be carried out at the same time. —BOCKUS, H. L.: *Gastro-enterology*. Vol. 2. W. B. Saunders Company, Philadelphia, 1944. pp. 858-901.

DECOMPRESSION SICKNESS (BENDS) FOLLOWING AN OXYGEN DIVE

REPORT OF A CASE¹

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A review of the literature on decompression sickness, since the time of Paul Bert, reveals no incidence of bends following diving when oxygen alone was employed as the breathing medium. This is not surprising, inasmuch as pure oxygen diving has only recently been investigated. The use of pure oxygen at 60- and 50-foot gage pressure in the treatment of bends, as advocated by Behnke², has not been productive of any symptoms referable to bubble formation.

The likelihood of bends following an oxygen dive seems readily plausible when two facts are considered: Bubble formation is an inherent property of all gases including oxygen; decompression sickness occurs on prolonged high altitude flights, when the plane crews have used oxygen as the breathing medium for periods of time sufficiently long (4 hours) to eliminate approximately 90 percent of the body's dissolved inert gases.

Gersh and Hawkinson³ have furnished experimental proof of bubble formation following high pressure exposures in which animals were saturated with 99.6-percent oxygen. The tendency to bubble formation is not as great, however, as that following exposures when the saturation is accomplished with compressed air, helium-oxygen mixture, or argon-oxygen mixtures.

It is presumed that intra- and extra-vascular bubbles, including those whose chief content is oxygen, produce symptoms mainly through ischemia or anoxia of the supplied tissues incident to circulation blockage. The anoxic tissue acquires oxygen from the

¹ From the Experimental Diving Unit, Washington, D. C.

² BEHNKE, A. R., JR.: Symposium on industrial medicine; effects of high pressures: prevention and treatment of compressed air illness. *M. Clin. North America* **26**: 1213-1237, July 1942.

³ GERSH, I., and HAWKINSON, G. E.: Formation and Appearance of Tissue and Vascular Gas Bubbles after Rapid Decompression of Guinea Pigs from High Pressure Atmospheres; Investigation and Report. Report No. 1, Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md., 7 March 1944.

adjacent bubble by diffusion, resulting in a decrease in the size or complete dissolution of the bubble and abatement or disappearance of symptoms.

Recently a considerable number of divers have complained of skin rash, fatigue, joint pain, and numbness and tingling in the extremities after surfacing from prolonged exposure (from 20 to 120 minutes) to oxygen under high pressures (from 40 to 100 feet). The disappearance of these symptoms after a short period of time on the surface seems consistent with the theory that oxygen diffusion to anoxic areas leads to a reduction in the size of the gas emboli.

This phenomenon is in contrast to the persistence of symptoms following dives in which air or helium-oxygen mixtures have been breathed. Inasmuch as inert gases act only as fillers and do not enter into chemical reactions, there is no extra avenue of dispersion provided, as there is with the combustible oxygen.

Possibility that oxygen storage in the tissues, if this occurs, or that excess of oxygen in the tissues during high pressure exposure would minimize the diffusion from the bubble, merits consideration. Inasmuch as the majority of embolic blockage symptoms are probably anoxic manifestations, it is suggested that symptoms might be delayed because of the tissue oxygen abundance. Nevertheless an anoxic area seems an eventuality when embolic blockage occurs, because oxygen combustion in the tissues continues and will finally deplete the oxygen supply, no matter how great its amount. That the extent of the anoxic area possibly is decreased by oxygen diffusion from the richly supplied adjacent areas, and that the character of the symptoms is thereby rendered mild, is consistent with observations that the symptoms are not grave.

Infrequently descent from altitude in the low pressure chamber because of bends has not resulted in immediate complete disappearance of symptoms. It is apparent that in these cases removal of the pressure differential and the diffusion of combustible gas was not sufficient to cause complete bubble absorption. Immediate disappearance of symptoms following application of a few pounds of positive pressure emphasizes the importance of this procedure when symptoms persist after descent to ground level.

The following case illustrates the persistence of symptoms attributable to oxygen emboli and their immediate disappearance with recompression treatment.

Case report.—A chief petty officer, first class diver, age 23 years, in average physical condition, made a dive at 80-foot gage pressure for 2 hours, breathing 99.6-percent oxygen. After surfacing, he complained of fatigue and pain in his hands and feet. Twenty minutes later he reported that the condition of his hands was improved, but his feet were numb and still aching.

It was decided to leave him at the surface for a longer period of time, as the emboli were thought to be composed largely of oxygen and would most likely be absorbed. One hour later the numbness and pain in his feet had increased. He was placed in the recompression chamber and air pressure was applied. At 30 feet, he reported complete relief of symptoms. The pressure was increased to 100-feet gage and he was surfaced on the air treatment table. After surfacing he stated that he was completely symptom free.

The relief obtained by recompression is indicative that vascular emboli were present. The prolonged symptoms in the feet might be explained by the excess oxygen in solution in the tissues preventing any rapid diffusion of oxygen from the emboli.

CONCLUSIONS

1. Following prolonged increased pressure exposures while breathing 99.6-percent oxygen, it is possible to produce bubble formation.
2. The air treatment table for decompression sickness should be used if symptoms persist after an oxygen dive.



INTESTINAL ANTISEPTICS

Intestinal infections are usually divided into two categories: Typhoid and paratyphoid, in which the local intestinal lesions are accompanied by systemic invasion; and dysentery, cholera, and the bacterial food-poisonings, with the infection confined to the gut. So far no drug of the sulfonamide series has proved effective in shortening the chemical course of enteric infections, although amelioration of the toxemia has been claimed. The failure to cure or to eliminate the infecting organism may be attributed partly to the pathology of typhoid, which makes the organism in the lymphoid tissue and in the gallbladder rather inaccessible to attack, and partly to the natural resistance of the typhoid-salmonella family to the bacteriostatic action of the sulfonamides. Thus salmonella gastro-enteritis, although a self-limited and localized disease of one or two days' duration, is frequently followed by a convalescent carrier state which is quite unsuceptible to sulfonamide therapy. Therefore the search for new drugs that may prove effective against this group of intestinal pathogens still goes on.—LEADING ARTICLES: Intestinal antiseptics. Brit. M. J. 1: 157-158, February 3, 1945.

BILATERAL DEPRESSED FRACTURE OF THE ZYGOMA

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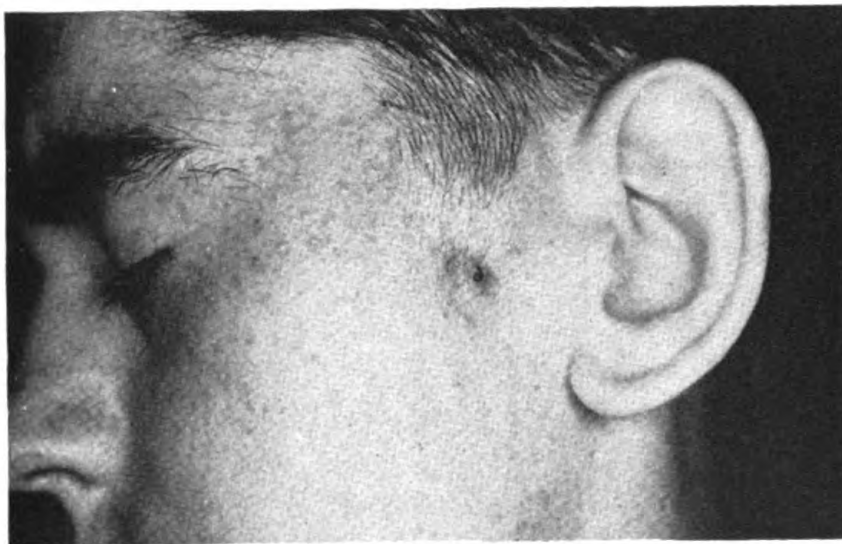
Concomitant fractures of both zygomas are rather uncommon, but when the cause is spectacular, recording in the literature seems especially justified. The treatment used in this particular case is simple yet effective, and is brought to the attention of those who may find it of value in the handling of zygomatic displacement.

Case report.—The patient, age 20 years, was admitted to an overseas general hospital following a self-inflicted gunshot wound of the left zygomatic region, and was found to be emotionally unstable. His past history revealed that during the year he had suffered from insomnia, anorexia, fatigue, loss of weight, and despondency; suicide had been contemplated on several occasions. Just prior to admission he went out on liberty and drank a couple of beers. Upon returning to the ship he took a revolver to the shower room and deliberately shot himself in the cheek while in a fit of depression.

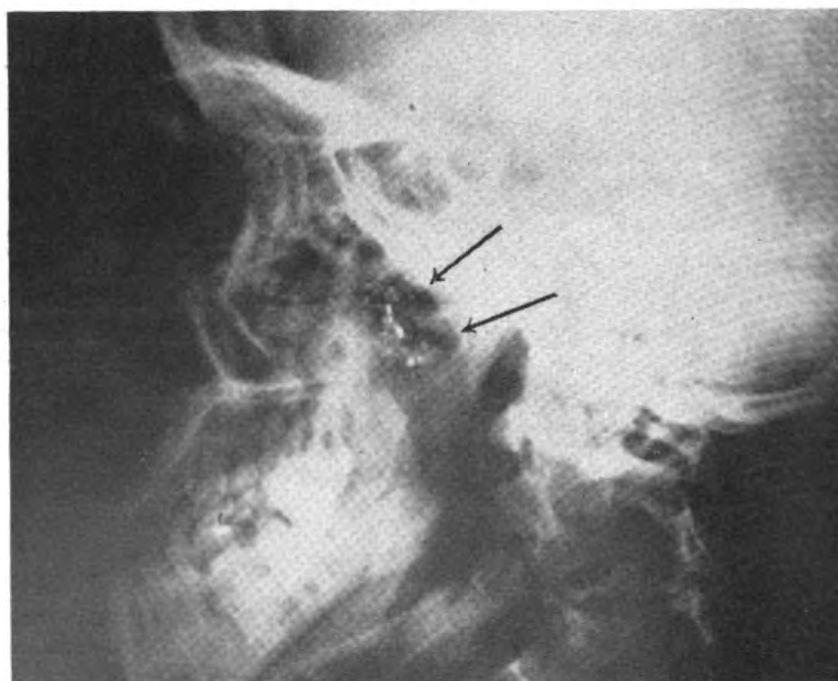
The patient was put aboard a Naval hospital ship for transportation to the continental United States with the diagnosis of depression, reactive. On admission to the neuropsychiatric ward of a shore hospital he appeared quite timid, was disgusted with everything, but exhibited no symptoms of delusion. After a period of observation during which he remained depressed and did not improve he was transferred to this hospital.



1. Healed wound over the left zygoma.



2. Healed wound in right side of face, showing the exit of the bullet.



3. Roentgenogram showing the pathway of the missile.

Examination showed the patient to be thin, frail, and fairly tall, with the broad high forehead and somewhat pigeon-breasted chest of the rachitic. There was a healed wound over the posterior end of the left zygoma (fig. 1) and a similar but smaller one on the right side (fig. 2). The patient was unable to open his mouth more than 5 millimeters, suggesting pressure from depressed zygomatic arches. His weight was 145 pounds, pulse rate 62, and temperature 97.6° Fahrenheit.

X-ray examination of the skull showed an unusual injury, apparently the result of a bullet which passed completely through the face from side to side.

The wounds and metallic spotted pathway indicated that the course of the missile was beneath the zygomatic arches, posterior to the maxillary sinuses just above the pterygoid processes, beneath the floor of the middle fossa, behind and below the ethmoid and sphenoid sinuses, and anterior to the condyles of the mandible (fig. 3). Despite the proximity of the opaque material, the coronoid processes of the mandible seemed to be intact. The zygomatic processes appeared normal except for a questionable defect in the right arch.

The pathway of the bullet led to the epipharynx, and appeared to have avoided any of the significant structures in this area.

Both fractures were reduced by the Gillies method. An incision was made through the skin and superficial fascia slightly above the hairline, and dull dissection was extended into the temporal fossa immediately below the depressed bone fragments. By introducing a slightly curved heavy retractor and lifting the end, the zygomatic arch was elevated into position. The incision was closed with fine nylon sutures. Following the operation trismus disappeared and normal function of the joint returned.

This case is unusual because the bullet traversed such an accurate horizontal plane through the posterior part of the pterygo-maxillary fossa that it avoided encounter with any structures of magnitude and importance. The treatment of such fractures by this method is simple and yet assures the operator an accurate result; restoration of facial contour is clearly evident when the fragments are in normal position.



ELICITING ACHILLES TENDON REFLEX

In order to obtain maximum reenforcement to the sometimes fugitive Achilles tendon reflex, the subject, shoe unremoved, is seated on a stool having a rung so placed that when his right foot is firmly upon it, both his foot and thigh will be parallel to the deck. The rung will pass just anterior to the heel of his shoe and beneath the greater arch of his foot. His left leg is then crossed over his right. With a percussion hammer a sharp tap upward on the sole of the right shoe in the region of the second tarsal-metatarsal joint is given. The opposite patellar tendon is tapped to elicit the knee jerk. The position of the legs is then reversed to test the opposite reflexes.

The reenforcement is obtained from the tension placed on the calf muscles by the patient's seated position. The response consists in plantar flexion of the foot tapped. This method is admirably adapted to the testing of large numbers of men. It is simple and rapid. Furthermore the contralateral knee-jerk can be tested simultaneously.—LEWIS, L. W., Apprentice Seaman, V-12, U.S.N.R.

UREMIA FROM TOXIC PIGMENT NEPHROSIS SECONDARY TO COMPRESSION OF VOLUNTARY MUSCLE

REPORT OF FATAL CASE

RALPH H. HOMAN
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and

CLARK E. BROWN
Commander (MC) U.S.N.R.

Toxic nephrosis with acute renal insufficiency has been seen to develop from compression necrosis of voluntary muscle as a typical wartime phenomenon. Following World War I, Minami (1) presented 3 cases of fatal renal tubular nephrosis complicating muscle injury sustained in burial under debris, and discussed others appearing in the German literature. Recently Bywaters and Dible (2) have reported 22 additional instances which occurred during the bombing of England. Muscle compression and renal insufficiency appear to have developed in an unusual manner in the patient whose case report follows. The syndrome occurred during the patient's course of treatment for manic-depressive psychosis.

Case report.—A 23-year-old officer was admitted to a dispensary on 8 February 1944 because of mental disorientation and confusion. A diagnosis of psychoneurosis, unclassified, was made and 2 days later, under heavy sedation with pentobarbital sodium, he was admitted to a station hospital for evacuation from the combat area. A relatively complete history and examination there showed a previous state of good health with freedom from injury or chronic disease. The patient's weight was 160 pounds, his nutrition good, his blood pressure 150/85. He remained at the station hospital for 6 days. Details of his treatment were not known, but on his evacuation tag the following notes were made: "Noisy, poor contact, and uncooperative. Physical condition—temperature 100.4° F., dehydrated. Treatment—intravenous 2,000 cc. normal saline containing 1 gm. sulfadiazine."

He was then evacuated to this hospital by plane under full-pack restraint in a Stokes litter. The plane trip is judged to have taken between 7 and 8 hours, and the patient was admitted at 1700 on 16 February. On removing him from the full sheet pack it was noted that abrasions were present over the right axillary fold, lumbar region, and both ankles. Bluish bruises were seen over the upper part of the chest, around the axillary folds, and over both hips. The patient was delirious, dehydrated, and groaned as he moved. The temperature was 103° F., and blood pressure 110/70. There were no other pertinent physical findings.

During the patient's subsequent 5 days in the hospital he experienced periods of negativistic catatonia alternated with excitement bordering on vio-

lence. He fought most approaches, vomited about half his tube feedings, but required only a moderate amount of sedation. Three infusions were given, two of dextrose and saline, and one of saline solution, the latter being given on the day of his death.

His temperature slowly dropped to normal and he appeared to improve until the morning of his death on 20 February. At this time a right parotid swelling developed which was diagnosed as suppurative parotitis. At 1530 he suddenly became stuporous, his breathing shallow and rapid, and his pulse slow, full, and regular. The blood pressure was 100/40. His coma deepened and he died at 1930.

The attendant stated that the patient had been incontinent but urine leakage was small. He had been catheterized on the day before death and 240 cc. of brownish urine having a fine coffee-colored sediment was recovered. With the exception of a blood Kahn test which was negative, it had not been considered necessary until then to do further laboratory work. Laboratory studies made on 20 February yielded the following findings. The hemoglobin content was 70 percent, the erythrocyte count 3,260,000 and the leukocyte count 18,450. The blood sugar was 422 milligrams percent, the blood nonprotein nitrogen 288 milligrams percent and the blood carbon dioxide combining power 34 volumes percent. Blood smears were negative for malaria, and the urine was cloudy yellow with 4+ albumin, many granular casts, and a trace of sugar, and was negative for acetone and diacetic acid.

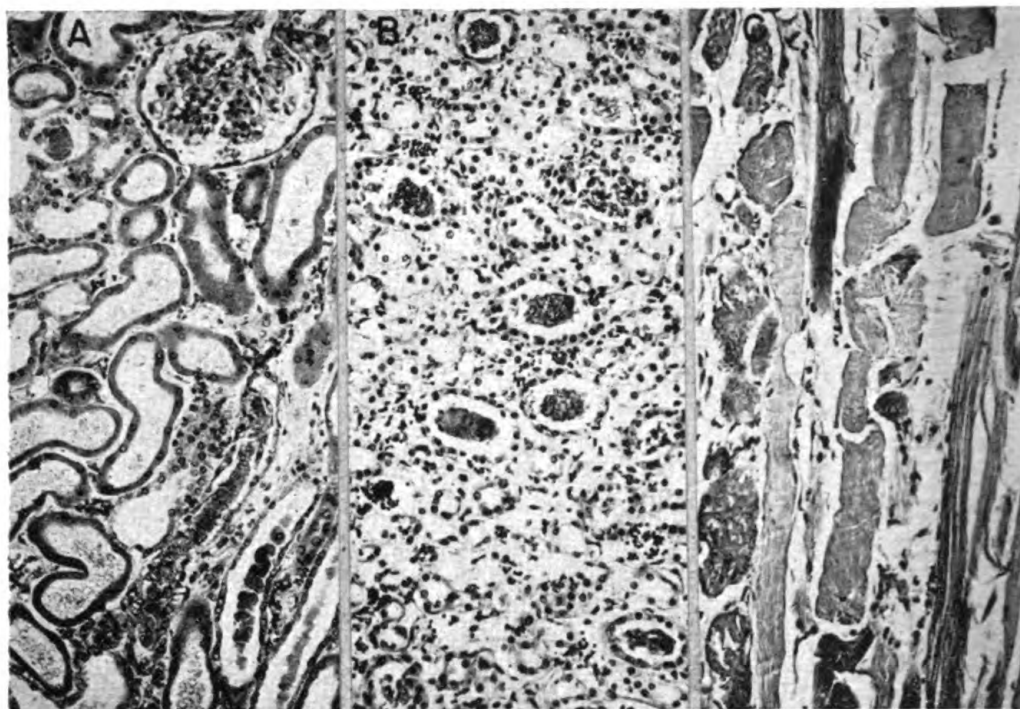
A blood specimen obtained at necropsy yielded a creatinine content of 17.9 milligrams percent and sodium chloride content of 593 milligrams percent.

Necropsy was performed 1 hour after death. Pertinent gross findings included the following. The bruises noted on physical examination were not seen. In the pectoral muscles there were pale yellow patches measuring as much as 3 cm. in diameter and having in places the opaque yellowish gray appearance described as "fish flesh." In the abdominal muscles larger areas of pallor were seen surrounded by edematous purplish muscle bundles. Other muscle groups were not explored, but no such changes were noted on examination of the lumbar and psoas groups.

A few flecks of fibrin were noted over the auricular epicardium. All lobes of the lungs except the upper right lobe contained scattered small patches of purulent consolidation. Bronchi and bronchioles contained similar exudate. Lung culture showed *Staphylococcus aureus*. At one point on the capsule of the spleen a small spongy network of confluent cystic structures was noted.

The right kidney weighed 180, the left 210 grams. The capsule was thin and stripped with ease, leaving a smooth, pale surface. On section the cortex was swollen, gray and conspicuously pale. The cortical markings were indistinct; the medulla was brownish. The pelvic mucosa was pale and smooth. The ureters were patent, and the bladder and lower urinary tract normal. The brain showed no change except engorgement of the capillaries. The remaining organs were normal. Blood culture was negative.

On microscopic examination the auricular epicardium was seen to be covered in places by thin layers of fibrin containing scattered polymorphonuclear leukocytes. In the consolidated portions of the lung the terminal bronchioles and the surrounding alveoli were filled with fibrin and polymorphonuclear leukocytes. In other areas the alveoli were filled with clear pink material resembling edema fluid. The capillaries were engorged. Numerous small shallow ulcers were noted in the mucosa of the lower third of the esophagus. A network of irregular vessels and small cystic spaces, some of which

**A.** Cortex of kidney.**B.** Medulla of kidney.**C.** Pectoral muscle.

contained erythrocytes, involved the capsule and the underlying pulp of the spleen. This vascular tumor (hemangioma) merged with the underlying sinusoids.

In the kidney a striking feature was dilatation of the tubules in the cortex. The epithelium of the proximal convoluted tubules was flattened and eosinophilic. The lumens of the tubules contained pink albuminous debris, many elements of which had a faint circular outline. The ascending loops of Henle and distal convoluted tubules contained numerous ribbonlike pigmented casts and groups of pinkish brown minute spherules. There was noted, in addition, considerable desquamation and reduplication of the epithelium of some of the ascending loops. The collecting tubules were filled with casts, some smooth and ribbonlike, others brownish and granular.

On frozen section of the kidney these casts gave a positive black reaction for hemoglobin following treatment with benzidine, acetic acid, and peroxide. One crystal, having the feathered edge of sulfadiazine, was noted in numerous kidney sections. The epithelial cells adjacent to the casts had pyknotic nuclei and some of them appeared to have been pulled away from their basement membranes. Mitotic figures were seen occasionally in the cells of the ascending loops and collecting tubules. The glomerular loops were delicate. The parietal epithelium of Bowman's capsule appeared swollen and the lumen contained albuminous material. The intertubular capillaries showed extensive engorgement with some diapedesis of erythrocytes into the edematous stroma.

Arterioles and major arteries were normal. The terminal ducts of the pancreas were dilated with inspissated secretion and their epithelium was frequently metaplastic. The islets were not altered. Sections of the pectoral and rectus abdominis muscles showed irregular necrosis of muscle fibers characterized by loss of striation, variability of staining reaction, fragmentation of bundles into opaque hyaline strands, and rupture of the muscle

bundles. This was accompanied by some hemorrhage and scant leukocytic exudate but by extensive interstitial edema. The remaining organs were normal except for some engorgement of the cerebral capillaries and cloudy swelling of the liver cells.

COMMENT

The relationship between compression injury of muscle and subsequent uremia from damage to the renal tubules has been well established (1) (2). Bywaters and Dible's 22 patients all died of renal insufficiency following severe oliguria or anuria within 9 days of injury. The histologic picture in the kidneys was characterized by various degrees of "desquamation, regeneration, necrosis, and fibrosis," most noticeable in the ascending loops of Henle and the distal convoluted tubules, and by the presence of pigment casts in these areas and in the collecting tubules. Myohemoglobin was identified in the urine of some of their patients, and the casts were found on sectioning to contain hemoglobin.

A toxic factor developing in the injured muscle in addition to tubular obstruction by myohemoglobin casts has been implicated by many authors to account for the damage to the tubular epithelium and the subsequent breakdown of tubular function. Such an explanation seems necessary to account for the extensive tubular damage which appears to follow injury to comparatively small masses of muscle.

A condition in the horse known as paralytic hemoglobinuria is well recognized. This condition is apparently characterized by muscle breakdown in the extremities following severe exercise, and its subsequent course is roughly similar to that seen in the human (3). The following table from Grzycki (4) compares the horse's blood in this condition and under normal conditions:

Chemical study of horse's blood

	Glucose (percent)	Phosphorus (milligrams percent)	Creatinine (milligrams percent)
Normal.....	0.077	2.92	2.64
Hemoglobinuric.....	0.214	6.30	8.22

This author accounts for the increase of glucose, phosphate, and creatinine in the blood of animals suffering from the disease, by increased breakdown of phosphocreatine or its defective resynthesis in damaged muscle. This phenomenon of distorted glycolysis in the horse may have a counterpart in the elevated blood sugar value and in the unusually high blood creatinine level in the patient whose case was presented.

The nature of the renal injury in this patient is not entirely specific. He had received at least one dose of sulfadiazine before admission to this hospital, none after. He was undoubtedly dehydrated many times during his illness, and he was suffering from a staphylococcic pneumonia which was undoubtedly a factor in his death. On the other hand the causal relationship between the muscle necrosis and the severe uremia is too close to be ignored.

The pathogenesis of the muscle necrosis is also not clear-cut. The patient may have received contusions by being bounced around in a bed or litter, or in the plane. The finding of deep bruises over the pectoral muscles and abrasions over an anterior axillary fold is evidence of a suggestive but obviously circumstantial nature so far as the tight application of a restraint pack is concerned. The pack probably was in place about 8 hours. This patient developed severe uremia from toxic pigment nephrosis secondary to compression of voluntary muscle. It is possible that this type of muscle compression injury could have resulted from the application of a restraint pack.

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PRONE TEST FOR RETROCECAL APPENDICITIS

A "prone test" for diagnosis of retrocecal appendicitis consists in palpating the abdomen with the patient lying with his face downward. In a patient with acute retrocecal appendicitis, with the subject in this position, gentle palpation of the right lower quadrant of the abdomen will elicit greatly increased tenderness, serving to differentiate the appendicitis from pelvic and kidney lesions.—WILLIAMS, V. T.: Acute retrocecal appendicitis; clinical sign of diagnostic value. *J. Missouri M. A.* 36: 126, March 1939. Cited in BOCKUS, H. L.: *Gastro-enterology*. Vol. 2. W. B. Saunders Company, Philadelphia, 1944. pp. 858-901.

RECURRENT HERPES SIMPLEX

REPORT OF CASE WITH SUNBURN AS PREDISPOSING FACTOR

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Herpes simplex is not an uncommon condition. Its etiology, pathology, and clinical appearance are well known and require no review. Treatment is nonspecific and for the most part purely symptomatic. Herpes simplex usually is accompanied or precipitated by a febrile illness. It may accompany respiratory tract infections, gastro-intestinal disturbances, menstrual dysfunction, and occasionally emotional states.

Recurrences are common, and tend to involve the same area each time. There appears to be no immunity in man against the herpes virus. Such recurrences may be due to a local skin sensitization on an allergic basis, a recrudescence of a latent persistent herpes simplex infection, or a combination of these factors.

In the case to be reported here localized herpetic eruptions recurred in a young male adult, each time following sunburn. Although herpetic lesions following sunburn are frequently seen, it is believed that this case is of interest because of the severity of each attack, the probability of local skin sensitivity, and the period of years over which these lesions have recurred.

Case report.—Four days before admission to the sickbay, a baker, third class, 21 years old, was overexposed to the sun. Two days before entry, he complained of a burning sensation on the right cheek, and shortly afterward a cluster of small pruritic vesicles appeared over this area. On the day of admission additional vesicles appeared on the cheek, paranasal, infra-orbital, and temporal regions, all on the right side. Some of the earlier vesicles had become dry and crusted. At this time the patient complained of intense right parietotemporal headache.

At the age of 3 years the patient sustained a burn of the right malar eminence which resulted from a fall against a stove. This injury healed without scar formation. He stated that beginning at the age of 4 years he has had one to three attacks of facial skin eruptions each summer, each lasting from 7 to 14 days. Each attack involved the site of the previous burn. At first these lesions were confined to a small area, but subsequent attacks involved a progressively larger area.

From the inception of this condition each eruption has been definitely related to a recent sunburn of the face. For this reason the patient has always attempted to avoid overexposure to the sun's rays. Even moderate exposure to the summer sun, however, precipitated an attack within 3 or 4



A. Appearance of lesions on admission. **B.** Appearance of patient on discharge.

days. During the past several years the patient had noticed, in addition to the rash, conjunctivitis and photophobia of the right eye with slight narrowing of the fissure.

There was no familial history of allergy or herpetic lesions. The patient had varicella in childhood. He had previously been treated for herpes simplex of the face in this sickbay.

Physical examination showed the patient to be in apparent good health. Positive findings were limited to the face. There was no fever or tachycardia.

There were dry, coalesced, brownish crusted lesions on the right side of the face extending to the paranasal fold and the infra-orbital and temporal regions. The base of each lesion was erythematous. There was in addition some infra-orbital swelling, causing narrowing of the fissure of the right eye, and there was a mild conjunctivitis of this eye. Two small tender preauricular glands were palpated.

The patient was treated for 5 days by sedatives for headache, and 5-percent sulfathiazole ointment to the skin lesions. After 4 days the crusted area began to clear, leaving a pink epithelizing surface. The intense headache had subsided and the preauricular glands had regressed. The patient was discharged to duty and advised to avoid overexposure to the sun.

SUMMARY

A case of actinic-induced herpes simplex recurrent over a period of 16 years is reported.

This case is considered of special interest because of the span of years over which the lesions have recurred, the severity of each attack, and the probability of local skin sensitization.

EIGHTY-THREE PERCENT BODY SURFACE BURN WITH RECOVERY

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Within recent years the size of body surface burn which a person can sustain and survive has steadily increased. The present case illustrates to what length this progress has reached. It describes, moreover, many of the factors and the complications often encountered during the course of treatment of serious burns.

Case report.—A 19-year-old male was admitted to the hospital 4 hours after having been burned in a gasoline explosion. Gasoline sprayed on his clothing and exposed parts of his body was accidentally ignited, and was extinguished by slapping, rolling on the ground, and finally being enveloped in a blanket. Within an hour a nearby dispensary had administered morphine, $\frac{1}{2}$ grain, subcutaneously and covered the burn area with vaseline dressings and bandages.

On admission the patient's temperature reading was 102.8° F., pulse 100, and respirations 26; he was excited and in shock. Examination revealed second and third-degree burns of the entire body, except that part of the head covered by thick hair, the short edges of which were burned; the feet and ankles, which were covered with field shoes; and the lower abdomen, perineum, genitals and upper thighs, which were clothed in abbreviated shorts. There was a 3-inch band of burned skin on each buttock, from the waistline to the infragluteal fold.

Both conjunctivae were burned, and there was an ulcer of the right cornea 2 by 3 mm. in diameter. The mucosa of the nose, the fauces, and pharynx was fiery red and congested from first-degree burn. Coarse moist râles were found in both lungs, indicating a pulmonary involvement of indeterminate extent.

Careful measurements made on admission and at later dressing periods showed that 83 percent of the boy's body surface area, according to Berkow's method of computation, was burned.

Course.—Besides 1,250 cc. of plasma, morphine sulfate was administered continuously intravenously until a total of $\frac{3}{4}$ grain was given, and a calming effect, as well as relief from pain, was obtained. Many small particles of charred eyelashes and skin were removed from both eyes.

Under aseptic precaution, and after shock was controlled, the primary dressings were removed and a cleansing irrigation with normal saline solution was given. A sterile vaseline-paraffin impregnated gauze dressing was applied, over which thick cellulose and elastic bandages were applied to all extremities. The face and trunk were left exposed. In the heat of the tropics, bandaging of the body is tolerated poorly and gauze impregnated with pure vaseline sticks to wounds because of melting and running of the vaseline. The trunk was treated by spraying with the vaseline-paraffin mixture, whereas the face was coated thickly with 5-percent sulfathiazole ointment. Tetanus toxoid

(0.5 cc.) was given hypodermically and sulfadiazine, 4 gm. orally. This was followed by sulfadiazine, 1 gm. every 4 hours.

The admission laboratory tests showed a hematocrit reading of 58 percent, an erythrocyte count of 6,200,000, leukocyte count of 30,400, and 15.5 gm. percent hemoglobin.

On the second day after admission the hematocrit reading was 56 percent. Intravenous plasma, 1,000 cc., and 100 cc. of serum albumin were given because the edema of the entire body was becoming severe, and recorded fluid intake was 470 cc. while the output was 885 cubic centimeters. Vomiting and delirium were present.

On the third day, anasarca was very severe. The hematocrit reading was 54 percent in the morning and 48 percent after the administration of 1,000 cc. of plasma and 200 cc. of serum albumin, while the temperature reached 103° F., pulse 102, and respirations 24. Because of the intolerance for liquids, a Levine tube was inserted through a nostril into the stomach and nasal feeding maintained for a week. The liquid intake on this date and thereafter exceeded 3,000 cc. and often reached 5,000 cc., and the output varied between 1,100 and 1,700 cubic centimeters.

On the fourth day, the blood count had returned to 4,530,000 erythrocytes, and the hemoglobin reading was 12.5 grams. The serum protein was 6.48 gm. percent with a specific gravity reading of 1.025. The hematocrit reading returned to normal on the sixth day and remained so thereafter. The highest sulfadiazine blood level obtained was 5 mg. percent, but its administration was discontinued on the twelfth day after the burn because of a cyanosis, though no other sign of drug toxicity was present and a therapeutic blood level had not been reached.

Because all burned areas were obviously and severely infected, on the seventh day penicillin, 12,500 units, was given intramuscularly every 3 hours, a daily total of 100,000 units. This was continued for 17 days making a total of 1,700,000 units.

On the ninth day of the burn the serum protein had dropped to 4.6 gm. percent, and 2 days later it was 3.7 gm. percent, the erythrocyte count was 4,500,000, and hemoglobin 11 grams. The hypoproteinemia was combated with plasma, from 500 to 750 cc., and serum albumin, 200 cc., daily.

Twenty days after the burn, a severe secondary anemia developed, the erythrocyte count dropped to 2,600,000, and the hemoglobin to 8 grams. Blood transfusions of 500 cc. each were given on three different occasions, and after 30 days the erythrocyte count was 4,040,000 and the hemoglobin concentration 11.5 gm. percent. At about this time the fever subsided.

Complications.—On the sixteenth day after the accident the patient developed bilateral popliteal thrombophlebitis. This was followed by a sudden onset of severe pain in the right lower chest anteriorly, which became worse on inspiration. There succeeded in rapid order pronounced pallor, dyspnea, shock, feeble pulse, drop in blood pressure, and coarse râles in the right anterior chest at the base. Temperature reading at the time reached 104° Fahrenheit. Although findings by a portable radiograph were negative, there was blood-tinged sputum, and a diagnosis of pulmonary embolism with probable infarction was made. The attack was shortlived and responded to morphine and oxygen. The pain rapidly disappeared, but the fever, lassitude and chest findings remained for 10 days.

Result and disposition.—On the thirty-third day after injury third-degree burn areas, one 3 by 9 inches, on the patient's forearm and the other 4 by 12

inches, on the right leg below the knee, were grafted using the Padgett dermatome and sieving the grafts. Skin areas previously burned but since healed were used as donor sites.

On the forty-sixth day after injury the patient was allowed up and about; all the burns were healed except a few small areas on the right forearm and leg not covered by skin grafts.

He was evacuated to the rear ambulatory on the sixty-second day, completely healed, and returned to duty 1 month later.

COMMENT

This case brings out several interesting observations: (1) As far as could be determined it is one of the largest surface area burns resulting in recovery which have been reported. (2) It illustrates many of the complications commonly encountered and the course frequently observed in serious burns, i.e., primary or neurogenic shock, edema, hemoconcentration, toxemia merging into the stage of infection, progressive anemia, thrombophlebitis, pulmonary embolism and infarction.

Skin-grafting had to be delayed for 1 or 2 weeks beyond its optimum time because no skin was healed well enough to be available as a donor site. The area of third-degree burn amounted to 75 square inches, but was not deemed a sufficient threat to the patient's life to make isografts advisable.

Inhalation burns of the respiratory tract were observed. The diagnosis of this condition is difficult, but presumptive evidence of a lung burn is had when dyspnea, voice changes, laryngeal edema, and toxicity more than would be expected from the area and depth of skin involved, occur.

There are no characteristic physical signs of lung burn, but any abnormal findings such as coarse or bubbling râles, dyspnea, signs of pulmonary edema, areas of decreased resonance, and clouding or mottling in the x-ray film are sufficient for making a diagnosis.

Infection is so habitually taken for granted in the course of burns that it has been considered part of it. When burns are seen late or after various methods of first aid have been used, infection is almost inevitable. Yet when seen early, when careful operating technic is used, and dressings are left in place for long periods of time (from 7 to 14 days), infection, while present, is often of no clinical significance. Infrequent changes of dressings, however, contribute to a smoother course and more rapid healing.



PENTOTHAL—METRAZOL ANTAGONISM

The administration of metrazol given intravenously markedly shortens the recovery phase following sodium pentothal anesthesia in man. In addition, it has relieved profound respiratory depression which occurred in seven patients; the depression was effected quickly and so completely that operation could be resumed with the administration of additional pentothal.—PICKRELL, K. L., and RICHARDS, R. K.: Pentothal—metrazol antagonism; method of shortening recovery period following pentothal anesthesia, clinical and experimental study. *Ann. Surg.* 121: 495-507, April 1945.



PENICILLIN IN PRIMARY ATYPICAL PNEUMONIA

Twenty-nine cases of primary atypical pneumonia were encountered during 12 months aboard a heavy cruiser in the Pacific area. The history in all cases was fairly typical. In every instance diagnosis was established by x-ray findings. There was a fan-shaped shadow of parenchymatous infiltration extending from the hilus outward toward but not reaching the periphery. Roentgenograms were utilized, also, in determining regression of disease and return to full duty status. Leukocyte count was nearly normal, extremes of the group being 11,500 and 4,900; differential counts were normal.

Only symptomatic therapy was given to the first 16 patients. In 11 of the last 13 cases, 200,000 units of penicillin were given in dosage of 20,000 units intramuscularly every 4 hours. A comparison of the therapeutic results showed that the gradual onset of this malady was, in every instance, complemented by a recovery by lysis. However in those treated by penicillin the regression of the thoracic findings was very rapid. A feeling of well-being was notable in all the patients so treated; most of them felt ready to return to duty immediately upon completion of the penicillin course.

Sick days in the 18 patients treated symptomatically numbered between 3 and 18, averaging 8.75. In the last 11 penicillin-treated patients sick days varied from 3 to 11, averaging 6.73. All of these men have been seen frequently since their return to active duty and there have been no recurrences.—LARSEN, F. S., Lieutenant (MC) U.S.N.R.

MEDICAL AND SURGICAL DEVICES

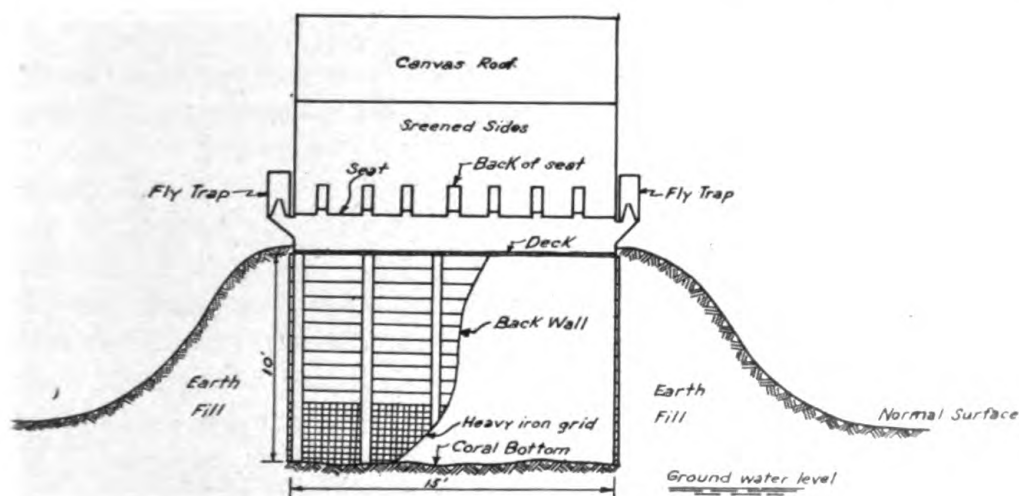
PRACTICAL HEAD FOR LOWLANDS

PAUL B. VAN DYKE

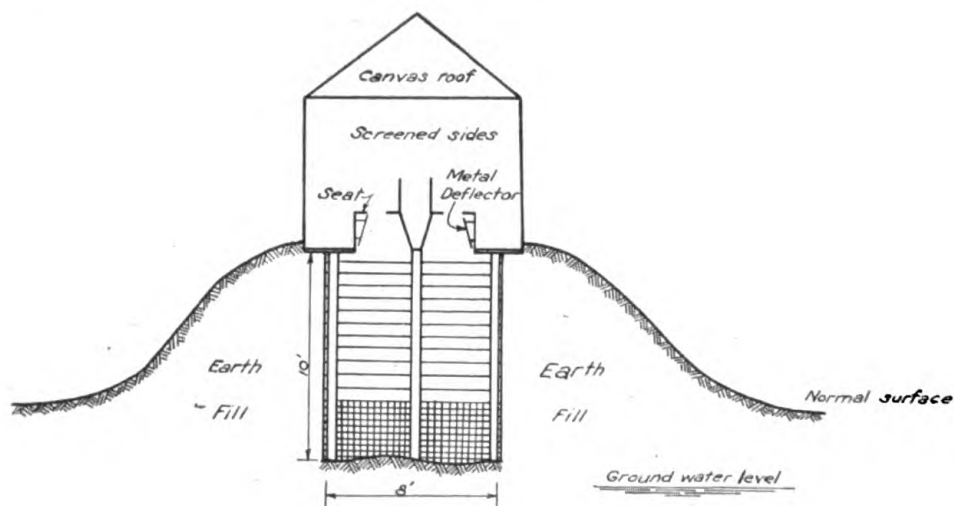
Lieutenant Commander (MC) U.S.N.R.

The camp site assigned to this construction battalion was on the coastal plain of this island about 400 yards inshore. It was semi-swampy, dry enough for ordinary activities in dry weather, but muddy and wet, with large areas of accumulated surface water in the rainy season. Pit-type heads were constructed and during dry weather they were adequate. With the onset of rainy weather, however, they were unfit for use. When sites for new heads were dug, the water level was found to be only 2 or 3 feet below the surface of the ground. An elaborate ditching system did not materially affect the underground water level. Equipment for the construction of water-flow toilets was not available.

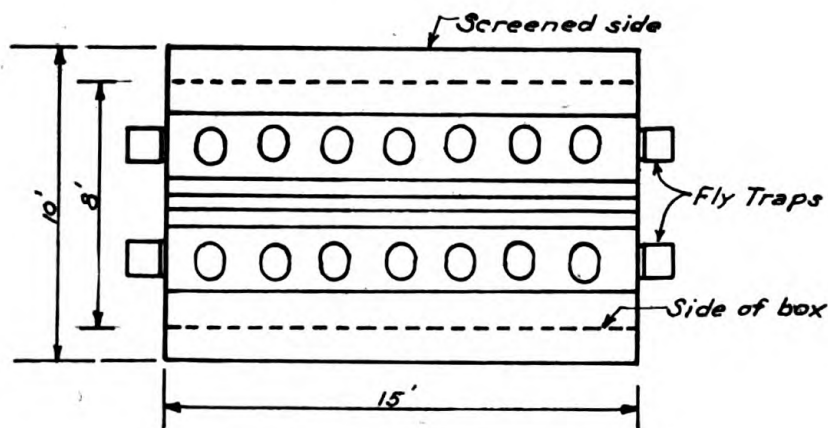
The pit latrine seems to be the most satisfactory type of head to use in the field. The framework is easily built and moved, and the pit is easily closed after it is no longer in use. The only problem was to create a pit of the required depth. As a pit could not be sunk to a sufficient distance beneath the surface of the ground, it was decided to complete the pit above the ground. The dry earth



1. Front view.



2. Side view.



14-Hole Elevated Head

3. Top view.

was excavated to a depth of 2 or 3 feet, the previously built structure was put in place, and earth was packed in a mound up to the floor of the frame.

Figure 1 shows the front elevation of the pit form, the platform, and the superstructure. It will be seen that the bottom of the form is open, and rests on a layer of coral. The lower 3 or 4 feet of the walls consist of a width of 2- by 2-inch Australian landing mesh. The open spaces of the mesh permit lateral absorption into the ground, and there is absorption downward through the open bottom of the frame. The rest of the frame is made of lumber; dunnage on heavy timbers is satisfactory for this purpose. The frame must be strong enough to withstand the pressure of the mounded earth. The floor, the seats, the screened walls and the

canvas top are then attached. Steps are added and the head is ready for use.

Figure 2 shows the side elevation, and figure 3 the floor plan. There are two rows of seven seats each in each head. Fly traps are built in either end of each row, and there are metal urine deflectors at each hole. The seats are provided with self-closing covers. When abandoned, the platform is removed and the pit closed.

The head requires a little more work to construct. It should be so placed as to take advantage of favorable surface drainage in a direction away from the camp site, in addition to the usual considerations in the proper placing of a head. It should be burned out every day, and the fly traps serviced. This type of head has been found very satisfactory in this low-lying area.



ACUTE PERICORONITIS

Acute pericoronitis is frequent among Naval personnel because the majority are at the age when the third molar is erupting. The third molar, however, should not be extracted in the presence of a pericoronal infection.

The following treatment will help in reducing the acute symptoms sufficiently to permit extraction:

1. Frequent hot saline lavage is given until the acute symptoms resolve or fluctuation appears.
2. When the third molar has become extruded and bites directly into the lower third molar flap, grinding the upper molar cusps, or extraction of the upper tooth frequently relieves the acute symptoms around the lower third molar.
3. The patient should abstain from smoking.
4. Daily cleaning of debris from under the flap should be carried out. Local application of any of the medicaments used in the treatment of Vincent's stomatitis is helpful.

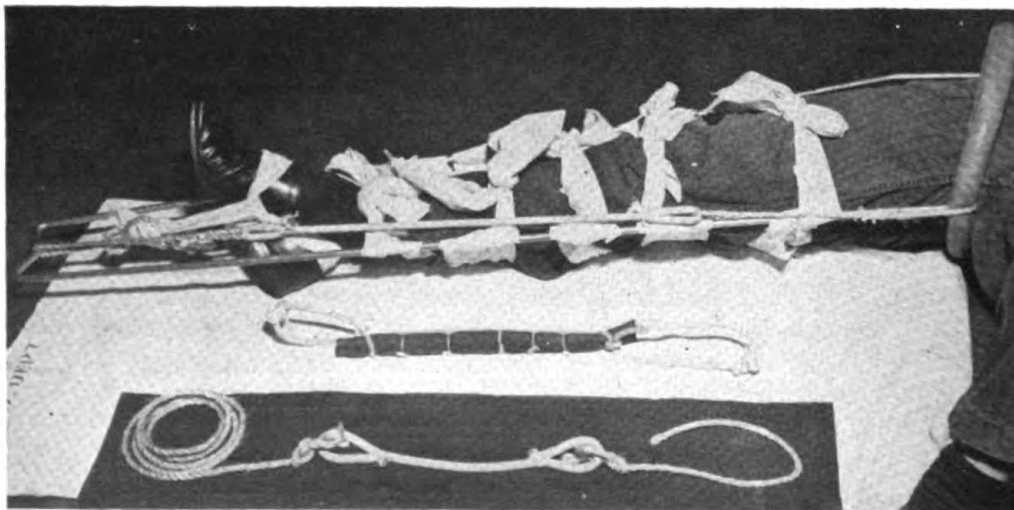
When the tissues after treatment do not present the normal tone and appearance satisfactory for extraction, a paste made of sulfathiazole or sulfanilamide and azochloramid in triacetin (1:500) is placed into the socket and covered with a sterile sponge. The patient is instructed to keep the sponge in place as long as possible, preferably for an hour. The postoperative results with this type of treatment have been excellent.—ANDREWS, J. N., Lieutenant (DC) U.S.N.R.

ELASTIC TRACTION DEVICE FOR THE THOMAS AND SIMILAR METAL SPLINTS

G. B. T. RIBBLE
Commander (MC) U.S.N.

The Thomas splint and similar metal splints are recognized as providing in emergency the best means of immobilization of fractured extremities. Traction is usually obtained by the use of a Spanish windlass.

The use of other portable traction devices, such as a spring scale or latex rubber tubing¹, is not original, but it is thought that many medical officers are not aware of the advantages of this type of traction in both emergency and definitive treatment.



The accompanying illustration shows a Thomas splint in which traction is obtained by means of a piece of elastic cord, $\frac{3}{8}$ inch in diameter, which has a pull of about 15 pounds when put under moderate tension. At the side of the splint is shown the elastic, and a "homemade" elastic made from a piece of discarded airplane tire inner tubing. Both these items are available aboard aircraft carriers.

This traction device has also been found satisfactory for definitive treatment for a few weeks, when circumstances make it inadvisable or impossible to apply a plaster splint. It makes movement

¹ COMPERE, C. L.: Experience in a theater of operations. *Bull. Am. Coll. Surgeons* 29: 95-99, June 1944.

of the patient as easy as if he were in a plaster cast, and can be applied in one-tenth of the time. When used definitively, a muslin cradle is made to support the leg, and Buck's extension with adhesive and elastic bandage is used.

This type of traction device possesses so many advantages over the Spanish windlass type of traction that the extension splints at the various battle dressing stations located throughout the ship have been equipped with the elastic traction device already attached and ready for use.

DESTROYER SURGERY

JOHN R. DURBURG
Lieutenant (MC) U.S.N.R.

Major surgery in the wardroom of a destroyer is not unique, but several items that may prove of interest to other destroyers' medical officers are portrayed in the accompanying photograph, showing a surgical procedure aboard the U.S.S. *Boyle*.



—Popular Science Monthly Photo.

The overhead light is permanently installed on a circular plate of steel. The spotlight seen near the hospital corpsman's head (right) is an ordinary battle damage control lantern. The battery for this is behind the wardroom transom with wires on the overhead. This light is adjustable, enabling a spot to be thrown in any direction on the operating table. Both lights are attached to the main and emergency electric circuits, and the spotlight, as stated, is also battery-powered. A switch on the overhead with appropriate labeling controls the lighting.

A suspended, removable table is attached to the overhead. The table has a combing so that the rolling of the ship does not spill the sterile instruments. The braces are surgically draped with sterile gauze ties. The instruments are safe; the table is out of the way and still accessible.

The operating table is the ordinary one provided for the sickbay of a destroyer. It is lashed to the wardroom table, which has the boards removed. Sterile space is provided at one end of the table for basins and extra instruments. The sterilizer is permanently installed as shown, and fixed in position by means of a steel brace.

Destroyer surgery is always doubly difficult because of the environment, the lack of help, the sea itself and numerous other factors, but this illustrated surgical setup brings it as close to a shore hospital as possible.



HEPARIN FOR OBSTRUCTING ADHESIONS

Intra-abdominal heparin to prevent obstructing adhesions should be limited to those who have had one or more operations for obstruction or repeated attacks following abdominal surgery. The hazards are hemorrhage, infection, and possibly delay in wound healing. The contraindications to its use are recent abdominal surgery, incomplete hemostasis, and possibly intestinal resection. The hazards should be recognized promptly when they appear, and can be checked by blood transfusion.

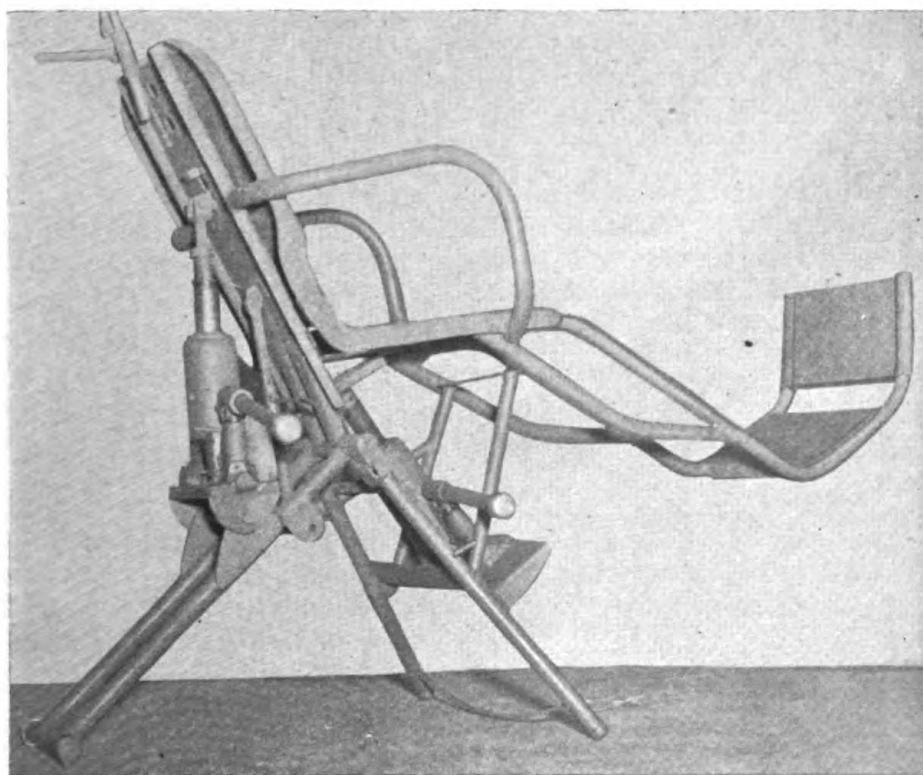
The complete absence of obstruction in the months and years following the use of heparin in the abdomen is promising; however, until there are more clinical reports, the use of heparin to prevent "obstructing" adhesions must be considered promising but not settled.—MASSIE, F. M.: Heparin in abdomen; clinical report. *Ann. Surg.* 121: 508-517, April 1945.

IMPROVISING IN THE FIELD

DUNCAN A. KING
Lieutenant (DC) U.S.N.R.

The field dental officer is required to use an x-ray machine equipped for large films only. The scattering of rays does not permit the maximum detail on a small dental film as does the regular dental machine. The standard machine, however, can be modified for dental roentgenographs by applying a cone made from a piece of sheet lead. A piece of paper is wrapped around the opening of the standard machine and shaped into a cone about 5 inches in length and tapering to an opening of $1\frac{1}{2}$ inches in diameter. After cutting this pattern, the paper is unfolded and placed on the sheet of lead. When the lead is cut, it is folded into a cone and held secure with adhesive tape. A cardboard casing is made over the lead cone and attached to the standard machine.

An x-ray illuminator is made by building a square box with a



Dental chair showing reconstruction from portable field chair. Each jack operates independently of the other, allowing adjustment to any height or angle.

2-inch square hole in the front panel. Through a hole in the back panel a frosted light bulb is placed and a light switch is attached to the side of the box.

A small wooden surgical table behind the dental chair aids the dental officer in his surgical procedures. This table has two distinct advantages; sterile towels can be placed on the table with the surgical tray and instruments, and all surgical instruments being behind the chair are out of the patient's view—a decided psychologic advantage.

A fan motor is attached to the regular foot pedal engine in a field dental outfit, and a pulley attached to the motor between $1\frac{1}{2}$ and $2\frac{1}{2}$ inches in diameter will produce the desired speed. The base of the dental engine and the fan motor are mounted on a board, placing the motor at such a height as to enable the use of the 17-foot 3-inch cord furnished in the field outfit. A wire can be extended to the base of the fan, which is mounted on the floor in back of the chair, and a fan switch is attached which permits foot control.

An adjustable chair can be constructed from the portable field dental chair with the use of two auto jacks. One jack is welded under the seat of the chair. Pumping the jack will raise the chair. The other jack is mounted behind the back of the chair. This facilitates letting the chair back. Arms and foot-rest are made from bent pipe. This chair reconstruction aids the dental officer greatly in adjusting the patient to the correct position.

ACKNOWLEDGMENTS.—Credit for this construction is given to Lieutenant, junior grade, E. G. Richardson U.S.N.R.; H. T. Lattis, Chief Aviation Machinist's Mate, U.S.N.; D. E. Parker, Aviation Machinist's Mate, first class, U.S.N.R.; C. E. Holler, Seaman, first class, U.S.N.R.; and G. T. Dieterich, Aviation Machinist's Mate, first class, U.S.N.R.

EDITORIALS

TROPICAL EOSINOPHILIA (?)

In 1932 Löffler¹ directed attention to several cases of an unusual transient pulmonary infiltration associated with a high eosinophilia. Since that time, and particularly during the past few war years, reports of similar cases have appeared in the literature with increasing frequency and under a variety of names. Currently the entity is popularly referred to as tropical eosinophilia.

Weingarten,² Emerson³ and others have reported cases which point to an endemic disease of coastal India, whereas Hirst and McCann⁴ have described the characteristic symptom complex in a patient in the South Pacific area.

From these examples the term tropical seems pertinent. But as the syndrome becomes more widely recognized it is apparent that its occurrence is not limited to persons who have resided or even have sojourned in tropical areas. Scherlis⁵ reports a case occurring in California, and Leutenegger⁶ has described small isolated groups of cases among troops in eastern Switzerland.

Moreover eosinophilia being regarded as the prominent feature of this condition, it is interesting to note that Allen⁷ has found eosinophilia to be a common entity in military personnel in the South Pacific, and he admits the difficulty in attaching a specific cause for the eosinophilia. The ubiquity of worms parasitic in persons living in tropical areas is such that exhaustion of every possible diagnostic means is mandatory before an indisputable

¹ LÖFFLER, W.: Zur Differential-Diagnose der Lungeninfiltrationen; über flüchtige Sucedan-Infiltrate (mit Eosinophilie). *Beitr. z. Klin. d. Tuberk.* 79: 368-382, 1932.

² WEINGARTEN, R. J.: Tropical eosinophilia. *Lancet* 1: 103-105, January 23, 1943.

³ EMERSON, K., JR.: Tropical eosinophilia. *U. S. Nav. M. Bull.* 42: 118-123, January 1944.

⁴ HIRST, W. R., and McCANN, W. J.: Tropical eosinophilia; report of case. *U. S. Nav. M. Bull.* 44: 1277-1281, June 1945.

⁵ SCHERLIS, S.: Loeffler's syndrome—eosinophilic pneumonia; case report. *Mil. Surgeon* 96: 349-354, April 1945.

⁶ LEUTENEGER, F.: Gehäuftes auftreten flüchtiger eosinophiler Lungeninfiltrate. *Helvet. med. acta.* 11: 111-115, April 1944.

⁷ ALLEN, H. C.: Eosinophilia in South Pacific. *U. S. Nav. M. Bull.* 42: 1241-1244, June 1944.

exclusive diagnosis can be rendered. The fact of not finding parasites or their ova in stool or sputum specimens does not necessarily rule out their presence. The task of demonstrating ^{8, 9} these elements in laboratory samples is thoroughly appreciated.

The migration of larvae of *Ascaris lumbricoides*¹⁰ through the lungs is generally known, and eosinophilia associated with asthmatic paroxysms has occurred in patients having a pulmonary infection with mites.^{9, 11} Moreover eosinophilia is a common finding in asthmatics. It is a symptom response to a disease even as is a headache, the degree being commensurate with the degree of lung involvement. The count may rise as high as 53 percent and according to Osler may persist in moderate grade between attacks.

Although massive eosinophilia and eosinophilic infiltration of the lungs are frequent and dominant features of the syndrome, their presence does not seem to be essential. Carter and his associates have demonstrated typical cases in which the eosinophil count was as low as 3 percent and there was no lung roentgenographic evidence of the disease.

Unfortunately all the salient points about this disorder fall into the category of symptoms which give little clue to specific pathogenesis. In the light of present knowledge the syndrome can be explained on a basis unrelated to peculiar geographic conditions. The evidence of mite infestation is too incriminating to be disregarded. Carter and his associates have identified 10 species in the sputum samples of persons suffering from the disorder, whereas Soysa and Jayawardena believe that a pulmonary acariasis caused by the inhalation of mite-laden atmosphere is the responsible agent.

These examples bring the cheese mite to the fore as the possible etiologic factor, an organism which has been particularly emphasized by Swiss investigators, the asthmatic symptoms being interpreted as reflex allergic irritations of a hypersensitive bronchial system.

Viswanathan and Natarajan¹², however, attacking the problem of causation from a different approach, have determined the cold agglutination reaction in 61 serum samples from patients with

⁸ MORGAN, C. N.: Amoebiasis; some difficulties of diagnosis. *Brit. M. J.* 2: 721-722, December 2, 1944.

⁹ SOYSA, E., and JAYAWARDENA, M. D. S.: Pulmonary acariasis; a possible cause of asthma. *Brit. M. J.* 1: 1-6, January 6, 1945.

¹⁰ EDITORIAL: Mites, asthma and arsenic. *Brit. M. J.* 1: 18-19, January 6, 1945.

¹¹ CARTER, H. F.; WEDD, G.; and D'ABRERA, V. ST. E.: Occurrence of mites (acarina) in human sputum and their possible significance. *Indian M. Gaz.* 79: 163-168, April 1944.

¹² VISWANATHAN, R., and NATARAJAN, B.: Cold agglutination in tropical eosinophilia. *Lancet* 1: 148, February 3, 1945.

the disease. Fifty-three showed positive cold agglutination, the majority having high-titer values above 1:256. Inasmuch as consistent high titers are obtained in atypical virus pneumonia and because the pulmonary lesions of both entities are grossly similar, similarity of causative agents is suggested.

Despite the speculative character of the conclusion, the cold agglutination test may be indicative, pointing to the same unknown element in the two disorders.

Until something more positive, however, is forthcoming concerning the cause of the syndrome, the term tropical eosinophilia had best be discarded as inadequate in depicting the disorder, and as leading to erroneous or missed diagnoses because of inability to elicit a referable geographic history.

HEMOTHORAX

The interval between the two wars has been productive of remarkable advances in chest surgery. This field once held inviolate to the surgeon's knife now permits daring access. Lobectomy, pneumonectomy and equally radical procedures are of common occurrence. These advances stem from World War I when management of chest injuries went through hectic empiric stages.

Chest wounds, nevertheless, still account for a high percentage of those who are killed instantly on the field of battle, and the patient who survives the immediate perils of a chest wound may succumb subsequently to cardiorespiratory impairment or to hemorrhage unless certain corrective measures are followed. Early standardization of methods in handling war wounds of the chest during the present conflict, however, has resulted in reduction of mortality from chest wounds. These measures for the most part are conservative, but hemorrhage of the chest is not different from hemorrhage in any other part of the body. It comes under the general surgical principle that demands immediate effective interference.

The anatomic features of the thorax as seen elsewhere in this *BULLETIN* (p. 15) vividly illustrate some of the problems in the management of hemothorax.

The controversy over air replacement after thoracentesis dates back to the multiple aspiration technic in cases of empyema. The same principle seems applicable in embarrassing hemothorax. However Kent and Tebrock have cogently demonstrated the fallacy of the method under these circumstances.

This is apparently at variance with the opinion that intrathoracic hemorrhage is intensified and prolonged by negative pressure. The point at issue, however, postulates understanding of the physiologic dynamics of an effusion of blood into the pleural cavity, including a consideration of the source of the blood, extent of injury and whether or not the lung is involved. Aspiration with or without air replacement presupposes these factors and the time interval between injury and thoracentesis.

Wounds of the pulmonary vessels are the most frequent source of hemothorax from battle trauma. Bleeding from the lung, however, is usually self-limiting unless due to rupture of a large vessel. The blood pressure of the pulmonary circuit is one-fifth that of the systemic circulation, and under the conditions of hemothorax accumulation of blood in the pleural cavity collapses the lung and compresses the bleeding vessel.

Maintenance of this collapsed state of the lung is the avowed purpose of air replacement. It assumes that hemothorax is not as effective as pneumothorax in compressing the lung and controlling pulmonary bleeding. Hemorrhage which cannot be controlled by hydrostatic pressure will probably not be controlled by air pressure. The danger of continued hemorrhage after 72 hours is minimal. At that time a firm thrombus should be formed, in which event air replacement for the control of hemorrhage is unnecessary.

On the other hand, when accumulation of blood is large enough to produce displacement of mediastinal structures or cardiorespiratory embarrassment, the hydrostatic pressure must be released regardless of time element. The collapsed lung however must be maintained until thrombosis and fibrin deposits can prevent further bleeding. Air replacement under these circumstances is justified, notwithstanding the likelihood of fibrothorax, infected superior pneumothorax, radical thoracotomy, and prolonged morbidity.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.
(For review)

A SHORT HISTORY OF NAUTICAL MEDICINE, by *Louis H. Roddis, M. D., Captain, Medical Corps, United States Navy*. 2d printing; 359 pages; 13 illustrations. The Paul B. Hoeber, Inc., New York, publishers, 1945. Price \$3.

The original printing of this book, the only history of naval medicine by an American, has now been exhausted for more than a year, and this second printing is the result of a continued demand for it from many sources. First published in 1941, newly enrolled medical officers of the Navy found it a work of great value in giving them a background of naval medical history. Part of its popularity was due also to the great wartime public interest in the history of the Navy and its Medical Department. Its value was quickly realized by editors and feature writers who turned to it for information demanded by newspapers and magazines. One public relations officer of the Navy stated that at least fifty articles had been written based upon material obtained from this "information-packed little book." Although the longest chapter, which takes up almost one-fourth of the whole book, is devoted to medicine in the United States Navy, it is hoped that the author will be able to complete the plan outlined in the introduction, and complete a book on the lives of the Surgeon General of the Navy which would form a companion volume to the present work.

Like the first printing this volume is attractively bound and despite the wartime restrictions which have necessitated a cheaper paper, the typographic make-up, as with all Hoeber publications, is remarkable for clearness and beauty.

STITT'S DIAGNOSIS, PREVENTION AND TREATMENT OF TROPICAL DISEASES, Volumes I and II, by *Richard P. Strong, M.D., Sc.D., D.S.M., C.B., Professor of Tropical Medicine, Emeritus, Harvard University, Colonel, M.C., United States Army.* 7th edition. 1827 pages; 398 illustrations. The Blakiston Co., Philadelphia, Pa., publishers, 1944. Price \$21 per set.

"Stitt-Strong" has been accepted enthusiastically as the standard reference and textbook on tropical diseases by the medical profession, particularly that portion of it serving in the Medical Corps of the Navy. The sixth edition served its readers well, but with experience gained at a rapid rate in this particular field during the past two years, there had been expressed the hope that the subject could be brought up to the minute. The author has faithfully fulfilled this need and has presented his readers with a working guide and a reliable store of information which will be most welcome to medical officers serving, or about to serve, in the West Pacific and the Far East, and to doctors at home watching and unable to escape the development and importance of tropical medicine throughout the world.

The refinements and added authentic clinical observations, laboratory methods and statistical data to be found in the seventh edition are most gratifying. The numerous added references in the bibliography at the end of each chapter are important features of the revision. Colonel Strong has selected well the new subject material in the text.

Drawing heavily upon experiences in the combat areas, the author has substantially revised the chapter on malaria, particularly the newer aspects of treatment. The therapeutic advances in trypanosomiasis, leishmaniasis and relapsing fever have been treated adequately, and information on the spirochetal diseases has been brought up to date. The classification of microorganisms of the dysentery group has been revised, a most helpful tabulation made and therapy discussed. Notable additions have been made to the chapter on cholera, particularly in respect to prophylaxis and treatment. The epidemiology and mortality statistics of plague have been modernized, and recent experiences in medication are discussed. Experiences with vaccination in yellow fever are thoroughly discussed. New subject material on rickettsial diseases includes insecticidal methods, the efficacy of vaccine and the pathologic aspects of tsutsugamushi fever. A discussion of dhobie-mark dermatitis has been added. The incidence and diagnosis of filarial diseases, particularly in the South Pacific, is a subject of current interest and will be read with advantage.

The chapter on general and statistical considerations is a most valuable one, as is also the appendix containing three sections and including an index or manual of clinical diagnosis, an enumera-

tion of laboratory procedure for diagnosis, indexed by disease, and discussions on tropical and personal hygiene and disinfectants and disinfestants.

The completeness and authenticity of these two volumes makes criticism impossible and praise inadequate.

HANDBOOK OF INDUSTRIAL PSYCHOLOGY, by *May Smith*. 304 pages. Philosophical Library, New York, publishers, 1944. Price \$5.

The author states in her preface, "This little book is not intended to be a detailed chronicle of psychology from the industrial standpoint, but to provide an introduction to the subject for those who are in some way responsible for others, or who have to get on with others." This should warn away the advanced scholar who is seeking a compendium of research knowledge on the subject. He will not find it here. The newcomer to the field, however, will find a pleasant, easy-reading introduction to the subject, covering the high spots in an interesting and often provocative fashion.

After an exceedingly sketchy historical introduction, the book takes up the application of medical and psychologic knowledge to the industrial problems of fatigue, the effect of environmental conditions upon output, job analysis and vocational selection, time and motion study, the relation of personality to productivity, motivation and work, and medical hygiene.

Although industry has begun only lately to pay serious attention to the existing material in the field and to encourage further research upon these vital problems, it has already benefited greatly. Much of this material is applicable to the military services. In the fields of medical hygiene, neuropsychiatric selection, and billet analysis the Naval service is well ahead of industry, and industry can learn much from the Naval experience in these fields, particularly from the prophylactic principles inherent in the procedures of military selection.

In some other fields, such as the effect on output of controllable working conditions and the relation of motivation and personality factors to efficient performance, the military services can learn from industry. Military personnel who find themselves in a command situation involving the necessity of attaining certain objectives with the human material at hand might well ponder the lessons of this book. They might even find a few answers to the ever present, complex problems of leadership.

LARGE SCALE RORSCHACH TECHNIQUES, A Manual for the Group Rorschach and Multiple Choice Test, by *M. R. Harrower-Erickson*, Acad. Dip., Ph.D., Research Associate, Department of Neuropsychiatry, University of Wisconsin; and *M. E. Steiner*, B.A., M.A., Personnel Section, General Electric Co.,

Bridgeport, Conn. 420 pages; 70 illustrations. Charles C Thomas, Springfield, Ill., publisher, 1944. Price \$8.50.

This is an elaborate technical manual dealing with the development of the Group and Multiple Choice Rorschach Techniques. The general reader who is not familiar with the Rorschach Test will be hopelessly lost among its professional intricacies, but the Rorschach specialist will find it a thorough and stimulating treatise which he will want on his reference shelves. The validating data are subjected to a detailed analysis and are presented clearly in innumerable graphs and tables, and there are complete instructions for the administration and interpretation of both forms of the test.

It is worthy of note that the best results with both group procedures come when the responses are subjected to an interpretive evaluation rather than when scored in standardized objective fashion. Even in its Multiple Choice form the Rorschach functions best in the hands of a trained clinician. Its metamorphosis into a completely objective, standardized, group paper-and-pencil test has not as yet been successfully achieved.

IMMUNO-CATALYSIS, by *M. G. Sevag, Ph.D., Assistant Professor of Biochemistry in Bacteriology, Department of Bacteriology, School of Medicine, University of Pennsylvania, Philadelphia;* with a preface by *Stuart Mudd, M.A., M.D., Professor of Bacteriology, School of Medicine, University of Pennsylvania, Philadelphia.* 272 pages. Charles C Thomas, Springfield, Ill., publisher, 1945. Price \$4.50.

This volume represents a collection and analysis of data in support of the hypothesis that humoral immunity is the result of biocatalytic processes. The arguments progress by means of presenting analogies between the *in vitro* and *in vivo* activities of various reagents in immune and enzymatic reactions as observed by Ehrlich years ago. The products of enzyme activities are considered as being inhibitors of the activating enzyme, and antibodies are therefore thought of as being inhibitors of the antigens stimulating their production. Included in the list of analogues are numerous organic enzymes such as the carbohydrates, urease, rennin, trypsin, papain, several found in snake venoms and the various toxins and other bacterial products.

Considerable emphasis is placed upon failures to demonstrate the presence in antibody of the antigen stimulating its production, which again is similar to the characteristics of enzymes. The thesis is developed that antibody globulin in immune serum represents simply an increase in and a change in the configuration of the normal globulin as a result of the catalytic action of the homologous antigen.

Although the concepts are based on complex processes the discussions are clear. Certain of the controversial aspects are emphasized and answered in a logical manner. The treatise is presented mainly in a prejudiced manner; this is quite proper, since the objective is to call attention to the possibility that antigens are immuno-catalysts. The book is well written and should be of particular interest to specialists in the fields covered. The listing of nearly 500 references adds to the value of the work.

SYMPTOMS OF VISCERAL DISEASE, A Study of the Vegetative Nervous System in Its Relationship to Clinical Medicine, by *Francis Marion Pottenger, A.M., M.D., LL.D., F.A.C.P., Medical Director, Pottenger Sanatorium and Clinic for Diseases of the Chest, Monrovia, California.* 6th edition. 442 pages; 87 text illustrations and 10 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers, 1944. Price \$5.

Every physician is aware that in its evolution, medicine has advanced through the anatomic and pathologic stages of development, and the physiologic aspect is now receiving the attention it has long merited.

A great deal of confusion has arisen in the clinical application of physiology concerning the function of the vegetative or sympathetic nervous system. Our present-day knowledge of the influence of the sympathetic nervous system upon the different systems of the body in health and disease is still incomplete, and in our search for a more comprehensive understanding we need textbooks such as Dr. Pottenger has compiled.

He has been able to bring up to date that which is known on the subject and has included an extensive bibliography. In addition he has combined anatomic, physiologic and clinical aspects of visceral disease with diagrams and illustrations to assist in the presentation.

The fact that there has been a demand for six editions of this book is ample proof that a monograph of this type is appreciated for its clinical value to physicians and should be included in all medical libraries.

ELEMENTS OF ELECTROCARDIOGRAPHIC INTERPRETATION, With 40 Plates Illustrating the More Important Deviations From the Normal, Selected from the Files of The Michael Reese Hospital, by *Louis N. Katz, A.M., M.D., Director of Cardiovascular Research, The Michael Reese Hospital, Chicago; and Victor Johnson, Ph.D., M.D., Professorial Lecturer in Physiology, The University of Chicago.* 3d edition. 44 pages. The University of Chicago Press, Chicago, Ill., publishers, 1944. Price \$1.

This pamphlet should serve a useful purpose in assistance to those interested in reviewing and interpreting electrocardiograms.

The plates presented are excellent, and the explanations are out-

lined in simple but intelligent and understandable detail. The appendix contains pertinent information concerning chest leads and the value that can be gained by them under proper use. Although this is not new to the field of cardiology, it is presented most concisely for the benefit of the reader.

In closing the authors have included a suggested procedure to be used in the reading of an electrocardiogram, which is complete and comprehensive.

SYNOPSIS OF CLINICAL LABORATORY METHODS, by *W. E. Bray, B.A., M.D., Professor of Clinical Pathology, University of Virginia; Director of Clinical Laboratories, University of Virginia Hospital.* 3d edition. 528 pages; 93 text illustrations; 20 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers, 1944. Price \$5.

In the reviewer's opinion, this is the best of the abridged texts. It is compact and concise, well-illustrated, and attractively bound and printed. It should have particular value for medical officers and technicians aboard ship or on foreign duty. Emphasis is laid upon methods rather than interpretation.

All subjects are well covered and the latest technics have been introduced. These include the Rh factor and the determinations of plasma salicylates as well as serum lipase. It would have been advisable, however, to describe the simplified copper sulfate method for total proteins of the blood. Likewise the ease of preservation of Russell's viper venom is sufficient indication for the presentation of this manner of determining prothrombin time.

The author could have initiated a new departure in the elimination of little used and inadequate methods, such as Dare's hemoglobin determination and the Takata-Ara test. He could have devoted less space to sputum typing and given that which was saved to duodenal drainage, especially the microscopic study. Under surgical pathology, Masson's original trichrome stain or one of its modifications should have been outlined. But these are minor criticisms which will vary according to the opinion of the reader.

This volume in its third edition remains one of the best of the texts in its field. It can be recommended without hesitation to all who do laboratory work.

AIDS TO ORTHOPAEDIC SURGERY AND FRACTURES, by *I. E. Zieve, M.A. (Cape-town), F.R.C.S. (Eng.), Surgical Registrar, Charing Cross Hospital.* 2d edition. 270 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price \$1.75.

This book is a pocket-sized text of the Student Aid Series and offers nothing more than a brief review of orthopedic subjects. The number of subjects covered is complete and each is concisely

presented with particular emphasis being placed on precautions for the prevention of complications. There are no illustrations, and technics of operations are not described other than to discuss the principle involved in a certain procedure. However the common manipulative procedures used in the treatment of fractures are given and it is the opinion of the reviewer that the subject is sufficiently covered to make this a satisfactory text for the medical student and a handy reference for the intern.

THE ART OF RESUSCITATION, by *Paluel J. Flagg, M.D., Chairman, Committee on Asphyxia, American Medical Association; President and Founder of the Society for the Prevention of Asphyxial Death, Inc.; Director of Pneumatology, New York World's Fair 1939, Inc.* 453 pages. Reinhold Publishing Corporation, New York, publishers, 1944. Price \$5.

The author has succeeded in his attempt to present the reader with a clear, precise, and complete picture of the asphyxia patient. He has presented the etiology, diagnosis, and treatment of all types of asphyxia in a straightforward and concise manner, stressing particularly the pathologic physiology involved. He also stresses the fact that a thorough knowledge of asphyxia should not be limited to the specialty of anesthesiology, since its application in all branches of medicine is equally as important.

Dr. Flagg, in his first few chapters, has discussed the historical aspect of asphyxia and resuscitation. He quotes some very interesting statistics of the incidence and mortality of asphyxia. A complete review is given of methods used in the treatment of asphyxia under various clinical conditions, plus many practical applications gained from the author's years of experience.

A large portion of this book is spent in demonstrating that asphyxia is a specific problem. Chapters discussing the relationship of asphyxia to each of such causative factors as birth, high altitude, carbon monoxide poisoning, anesthesia, submersion, poliomyelitis, electrocution, fire-fighting, mechanical obstruction, and clinical disease are authoritatively presented, even though written in an elementary and easily understandable fashion.

In the later chapters he covers the field of asphyxia and resuscitation. Dr. Flagg demonstrates the importance of asphyxia and resuscitation as a problem of the Army, Navy, Public Health, and of industrial medicine. Resuscitation procedures are presented from the viewpoint of the patient's condition rather than the availability or use of a new or particular type of mechanical appliance. Post-revival care of the resuscitated patient has been thoroughly stressed and well presented. The urgent need for including the science of pneumatology in the medical school and hospital curriculum is justly emphasized.

The reader's first impression is how could a writer condense under one cover such a vast amount of information and still have a book that is so easily read. The number of medical personnel who would not profit by reading this book are few. The average medical man usually thinks of asphyxia as a condition which occurs seldom and should be left to the specialist for treatment. No reader can finish this fine book without realizing the importance of all medical men having a clear-cut knowledge of gaseous exchange throughout the body. Were more doctors familiar with this phenomenon, the vagueness of the normal and pathologic physiology of high-altitude flying, deep-sea diving, salvage and industrial hazards, and gas warfare would be eliminated.

LEAD POISONING, by Abraham Cantarow, M.D., Associate Professor of Medicine, Jefferson Medical College, Assistant Physician, Jefferson Hospital, Philadelphia, Pa.; and Max Trumper, Ph.D., Lt. Commander, H(S), USNR, Naval Medical Research Institute, Bethesda, Md., Formerly Lecturer in Toxicology, Jefferson Medical College, Consultant in Industrial Toxicology, Cynwyd, Pa. 264 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price \$3.

The authors in presenting this book are convinced of the necessity for a more general appreciation of the extent of the lead health hazard and the importance of the early recognition of chronic lead poisoning. They have reviewed the enormous literature on this subject and have expressed their opinion on many controversial issues.

Among the better chapters are those on the industrial, biochemic, pathologic and clinical aspects of lead poisoning. In addition there is a chapter on the laboratory procedures for the determination of lead.

The book is recommended as a reference book and as a book for those who would have a comprehensive understanding of the nature, prevention, and management of lead poisoning.

ESSENTIALS OF ORAL SURGERY, by Vilray Papin Blair, A.M., M.D., F.A.C.S., Professor Emeritus of Clinical Surgery in the School of Medicine and Professor Emeritus of Oral Surgery in the School of Dentistry, Washington University, St. Louis; and Robert Henry Ivy, M.D., D.D.S., F.A.C.S., Professor of Maxillo-Facial Surgery in the Graduate School of Medicine and Professor of Clinical Maxillo-Facial Surgery in the School of Dentistry, University of Pennsylvania, Philadelphia; with the collaboration of James Barrett Brown, M.D., F.A.C.S., Associate Professor of Clinical Surgery in the School of Medicine, Washington University, St. Louis. 3d edition. 624 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1944. Price \$6.50.

The third edition of "Essentials of Oral Surgery" is a more complete version of the previously published two books which the

authors compiled from their wide experience as oral, plastic, and maxillofacial surgeons.

It comprises 624 pages and 467 illustrations of material well prepared as a teaching guide for students and as a reference work for practitioners in these specialties.

The text is comprehensive and embraces discussions of anatomy, diseases of soft and bony tissues, tumors and neoplasms, fractures of the jaws, acute and chronic infections and congenital defects of the lips and palate. This edition strives to bring up to date special sections which deal with shock, hemorrhage and burns, as well as newer methods of fracture treatment and general anesthesia for oral surgery. A chapter by Kazanjian describes some methods of surgical correction of the oral tissues to aid in the wearing of prosthetic restorations.

Other interesting topics are to be found in the chapters on "Affections of the Salivary Glands and Ducts," "Affections of the Tongue and Lips," and "Affections of the Nerves of the Face."

References are placed at the end of each chapter, but are not too abundant or varied. Many refer to an earlier work of the senior author, published in 1917.

The illustrations, while prolific in number, are not particularly new or original. Clinical photography, especially in color, has improved more than this edition suggests. Likewise some of the surgical technics could be elaborated upon, to include other and equally successful ways of managing some of the problems.

An instance is that of "Operation for Retraction of the Lower Jaw," pages 462-470. There is a school of thought which believes resection of the ascending ramus should be done at a higher level than here shown, by open operation exposure, and that direct wiring should be done to immobilize the fragments. Inclusion of this and other methods is desirable in such a publication.

Also on page 450, under "Perforations of the Palate," the illustrations depict a rather archaic diagram for closure of this defect. Actual practice shows that this scheme frequently fails, and further information than that "for more extensive perforations some plan of flap transplantation will have to be adopted," would serve to enlighten the reader.

The book covers a broad and varied field quite ably. It is edited by eminent authorities and should prove useful to both student and practitioner.



NOVOCAIN IN PENICILLIN

In order to counteract the pain from intramuscular injection of penicillin, novocain solution was added to the penicillin solution at the rate of $\frac{1}{2}$ cc. of 2-percent novocain solution per each intramuscular injection. In a moderately large controlled series, it was found that this procedure greatly lessened the discomfort accompanying the injections.

From cup plate assays of 24-hour samples of penicillin plus novocain solution, and with similar solutions of penicillin without novocain, it would appear that the addition of the novocain does not significantly affect the strength of the penicillin and that the novocain may be added at the time a 24-hour supply is being made up. It was noted that upon the addition of the novocain a fine precipitate formed, which became heavier after several hours. This can be avoided by adding the novocain to each dose immediately before injection.—POTTER, J. M.: Novocain in penicillin. *J. Canad. M. Serv.* 2: 255-257, March 1945.



PENICILLIN TOPICALLY

Under sterile conditions the sodium salt of penicillin is mixed with commercially prepared dehydrated plasma. From 10,000 to 20,000 units of penicillin to 0.2 gm. of plasma is a desirable proportion; however this ratio can be varied to fit the particular need. The plasma tends to be lumpy, but gentle stirring reduces it to a light fluffy powder. Penicillin is added, and after gentle stirring, a homogeneous mixture is obtained.

Uniform distribution of this mixture on the wound surface is accomplished by means of a powder insufflator. When sprayed on a wound surface, the penicillin-plasma mixture immediately goes into solution and the tissues assume a yellow color. Complete hemostasis must be attained before insufflation; otherwise the mixture will be washed off at once. Two-tenths gram of plasma is sufficient for fine frosting of a surface 100 sq. cm. in area.—CUTLER, E. C., and SANDUSKY, W. R.: Method for local administration of penicillin. *Surgery* 16: 937-938, December 1944.

PREVENTIVE MEDICINE

Captain T. J. Carter, Medical Corps, United States Navy, in Charge

UNITARY VENEREAL PROPHYLAXIS

SULFA-MERCURY COMPOUND AND ALLIED PREPARATIONS

K. P. A. TAYLOR

Lieutenant Commander (MC) U.S.N.R., Retired

The polyvalent prophylactic compound advocated by this writer (1) (2) has been favorably reported by Blute (3), who records its successful use in 80 consecutive cases aboard ship. During a 6-month period in which the sulfa-mercury compound was used, no venereal infections developed. In the same period 12 venereal infections (gonorrhea, lymphogranuloma venereum, or syphilis) occurred in a control group using the conventional silver salt and calomel ointment prophylaxis. The absence of chancroid is surprising, in view of the notorious inefficacy of calomel ointment against this infection.

Blute's results emphasize the superiority of the sulfa-mercury compound over the dual prophylactics. The compound will prevent the development of all venereal diseases if used within the 2-hour period following exposure. No authentic record of its failure has been encountered up to the present time.

Results with similar unitary prophylactics.—In this respect it is of interest to review recent reports concerning analogous unitary prophylactics which have since been developed. These are remarkably favorable. Kaufman and Litterer (4) used an 8.3-percent suspension of sulfathiazole powder in calomel ointment as an all-purpose (external and intra-urethral) prophylactic in 2,016 cases, without the development of venereal infection in any case treated within the 2-hour period. Zeve and Schneierson (5) used a 1.6-percent or a 3.3-percent sulfathiazole-calomel ointment mixture in 10,368 external prophylactic applications (not urethral) and had no syphilitic, chancroidal, or lymphogranulomatous infections in adequately treated personnel.

If sulfathiazole alone is proved locally effective against gonorrhea, chancroid, and lymphogranuloma venereum, it may be advantageous to use mercurous chloride rather than the oxycyanide as the second active ingredient of a unitary prophylactic. Previous

reports, however, have indicated that sulfathiazole is not wholly effective as a local prophylactic against either gonorrhea or chancroid. Stedman (6) had two failures in 297 men in whom 5-percent microcrystalline sulfathiazole prophylaxis was employed, while Greenblatt and associates (7) had 9 failures in 34 experimental inoculations of chancroid, when from 20- to 25-percent sulfathiazole was used. Until these issues are clarified, it seems desirable to supplement the action of sulfathiazole with the more active mercurial antiseptic.

Disadvantage of thick emulsion.—Blute found the sulfa-mercury compound irritating if retained more than 5 minutes. The prophylactic as prepared for him was difficult to expel, and it was necessary to remove it from the urethra by injecting mineral oil. Prolonged retention was undoubtedly caused by the thickness of the emulsion; the gum tragacanth was 4.4 percent in the preparation used, whereas it should be 2 percent. The formula is as follows:

	<i>Gm. or cc.</i>
Oxycyanide of mercury.....	.1
Sulfathiazole powder	5.0
Gum tragacanth	2.0
Water	100.0

This emulsion is expelled by urination or allowed to run from the urethra after completion of prophylaxis. It does not require removal by irrigation, although it is thick enough not to escape between the compressing fingers. Removal of the emulsion is important because enlisted personnel will not use an irritating preparation. An intoxicated or careless person may retain a too-thick emulsion for many hours, even over night, without discomfort, but urination will thereafter be painful for 2 or 3 days. I have not seen a discharge develop even under these circumstances.

The 2-percent tragacanth emulsion, however, if not retained over 5 minutes, is nonirritating, or at least not more irritating than 10-percent argyrol or 2-percent protargol. Urethral sensitivity varies; a few persons report irritation following injection of normal salt solution, but mercurial sensitivity or erythism may be anticipated in rare instances.

Similarly it is certain that the irritation reported by Blute in the 6-week-old sulfa-mercury compound is due to inspissation of a too-thick emulsion. The thinner preparation, if well shaken before use, has not been found to deteriorate or to become irritating after storage for 2½ years. It is reasonable to assume that alteration of the oxycyanide could occur under extremes of climate inimical to any pharmaceutical product. There is no objection, however, to the placing of a 6 weeks' time limit upon the use of the

sulfa-mercury emulsion, provided waste of materials is avoided. It is certain that this preparation need not be freshly prepared as do the silver colloids, and it is equally certain that no time limit is necessary under ordinary circumstances of Naval storage and use.

The sulfa-mercury compound has been manufactured and dispensed in individual prophylactic tubes by a commercial pharmaceutical company in Philadelphia, the original preparation of which was too thick; this has been corrected.

In order to assure at least 5 minutes' skin contact while the urethral instillation is retained, the emulsion should be liberally applied to the genitals and adjacent skin areas *before* the intra-urethral injection is administered. Thereafter the emulsion may be wiped off. The time required for prophylaxis is also reduced in this manner. If the emulsion is left on the skin, wrapping or bandaging is unnecessary, since staining or discoloration of clothing cannot occur.

Since this article was submitted for publication, Dr. Blute reports the successful use of the sulfa-mercury compound in 100 additional successive prophylactics. The men were exposed in highly infected posts of North Africa, in Naples, and in Norfolk. No venereal infections developed.

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A PHYSICAL JOB-PLACEMENT PROGRAM

JOHN L. BARRITT

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The placement of workers in jobs best utilizing their physical qualifications has many industrial and military advantages. With proper job placement of workers, industrial plants are able to increase substantially the production of military material. This is particularly true during the present labor shortage, inasmuch as there is an acute shortage of manpower for the heavier types of labor and an abundance in the lighter grades.

In the rehabilitation of disabled veterans, a proper physical job-placement program may contribute markedly to success. The first job at which the veteran tries his hand after his release from military service is important. A misfit job can do untold damage to his morale as well as aggravate his lingering disabilities. Few of these men will be able to step immediately into the routine of their former civil life unassisted. Many of them will be able to do so only if they are able to find a position least handicapping to their physical and mental disabilities.

The proper placement of a worker is not a haphazard undertaking. Those who are familiar with this phase of industrial medicine well know that a worker will not automatically find suitable work. To accomplish much in physical placement on the job, a definite program is required. It is because of this need for a workable, simple, physical job-placement program, that the following résumé is given.

CLASSIFICATION OF THE WORKER AND JOB

The first factor in a program of this kind is the evaluation of the physical condition of the worker. This is best done by means of an adequate preplacement examination according to a standardized method. As the results of the examination are to be used by lay persons, the results of the examination must be expressed in terms understandable to all. For this reason a system of coding is used in which the functional qualifications of the worker in terms of work are expressed (form 1). The medical diagnosis is purposely not given. The code number, however, is attached to the worker's record as a statement of his qualifications in terms of work. A file for mechanical card sorting may be installed.

FORM 1.—*Classification of worker. Code sample*

Qualities possessed by worker	Average degree	Exceptional degree	Minimal for hire
Strength	1 ✓	11	Minimal qualifications not given in code as they are understood to be requirement for hire for any job in plant.
Locomotion	2	22 ✓	
Manual dexterity	3	33 ✓	
Vision	4 ✓	44	
Hearing	5 ✓	55	
Psycho neurostability	6	66 ✓	
Ability to work in places where injury would result from loss of consciousness	7 ✓		
Appearance	8		
Ability to work in environment of:			
Excessive noise	A ✓		
Irritating dust or fumes	B ✓		
Extreme heat	C ✓		
Extreme cold	D		

Worker's name—John Doakes
 Code number—1 22 33 4 5 66 7 A B C

Clock No. 2548267

The job to which the worker can be safely and profitably assigned is the second factor to be considered. This requires a job classification which is arrived at by means of a job survey after the physical factors of the jobs of the plant are surveyed. The results are set down in code (form 2), a system being used which includes the same factors as were employed in the worker's code.

The job classification when done on a functional basis is not difficult. It is surprising how quickly the jobs of a large plant can be surveyed and coded, provided unnecessary detail is omitted. A mechanical punch card file may then be set up for the jobs of the plant.

FORM 2.—*Job survey. Code sample*

Requirements of job	Average degree	Exceptional degree	Minimal for hire
Strength	1 ✓	11	Minimal qualifications not given in code as they are understood to be requirement for hire for any job in plant.
Locomotion	2	22 ✓	
Manual dexterity	3	33 ✓	
Vision	4 ✓	44	
Hearing	5	55	
Psycho neurostability	6 ✓	66	
Ability to work in places where injury would result from loss of consciousness	7 ✓		
Appearance	8		
Ability to work in environment of:			
Excessive noise	A		
Irritating dust or fumes	B		
Extreme heat	C		
Extreme cold	D		

Job title (or) number: Electrician A (maintenance)
 Job code number 1 22 33 4 6 7

MATCHING THE WORKER WITH THE JOB

Once the worker has been classified and tagged with a code, and the jobs have been classified and coded, it is a relatively simple matter to match the worker with the job for which his physical

qualifications fit him. A common denominator is thus obtained by which the worker and job can be matched. The matching is not dependent upon medical knowledge, nor upon a technical knowledge of the jobs in the plant, and may be made with excellent results by an unskilled worker.

In the matching of a single worker, applying for hire or transfer, a comparison of worker and job code numbers is all that is required. However in the case of group hirings or transfers, a standard card sorting system can be used advantageously. In this way a thousand jobs may be quickly checked to find the one that will fit an unusually hard-to-place worker. Conversely a large number of workers can be checked quickly to find the one suitable for a specific job (chart 1).

In the placement of veterans, the classification and coding may be done at separation centers, and the regular separation examination used as a basis. By checking with standard lists the veteran could be informed just what specific jobs he is able to do. This is given in specific detail rather than in generalization. Furthermore it is possible for many industrial plants, especially those under government control, to set up job survey programs under supervision of the government.

The use of a placement program for active military personnel, however, involves many complicating features, although a functional system of placement may be helpful. In this way the understanding of the qualifications of certain branches of the service could be clarified and the under-par inductee be more profitably and efficiently placed.

By using additional code characters, educational and training qualifications could be added to the code.

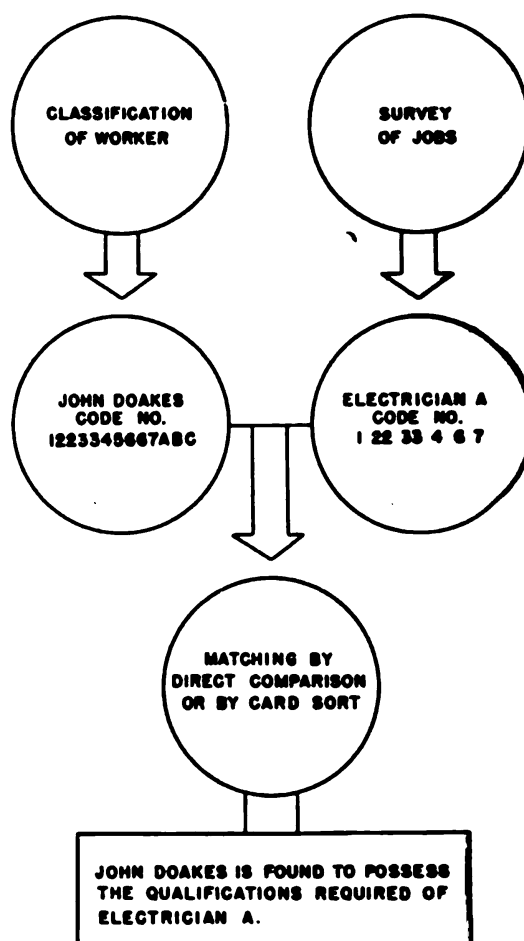


Chart 1.

The system described has many outstanding advantages. By use of a positive system of matching, and a functional system of coding, many of the complications of matching are eliminated. The system is applicable to mechanical card sorts, which renders it suitable for large mass placements. The positive system of coding requires a larger system of code characters but the disadvantage is more than outweighed by the advantages. As a placement program must be kept simple in order to be workable, some of the fine points have been sacrificed. Production men in industrial plants have little time for complicated systems.

COMMENT

It is believed that the plan described can be instrumental in improving a critical labor situation in Navy operated plants as well as in privately operated ones. The value of such a plan in the placement of veterans is obvious, while the use of a similar plan in the placement of active military personnel is worthy of consideration.



THYMUS MUTATION IN SKIN WOUNDS

In the course of experiments in which the effects of various substances on a healing epithelial wound in the rat were tested, a transformation of thymus tissue from a predominantly lymphatic to an epidermal structure was observed. Because it has been suggested that the small lymphocyte may have a function in the formation of fibrocytes and collagen fibers, thymus tissue, in which this cell is very abundant, was taken from rats 3 to 6 weeks old and applied to the surface of open wounds made on adult rats of the same strain. A stratified squamous epithelium was developed on the surface of skin wounds. This epithelium was derived from the thymus reticulum cells. Such a change in the thymus tissue is not surprising when other evidence on the potentialities of the thymus reticular cell is reviewed.—DUNN, T. B.: Behavior of thymus tissue transplanted to skin wound. J. Nat. Cancer Inst. 5: 285-288, February 1945.

STATISTICS

HEALTH OF THE NAVY

The statistics (annual rates per 1,000) appearing in this summary were compiled from data contained in monthly reports of communicable diseases received in the Bureau for the months of October, November, and December, 1939-1944:

ENTIRE NAVY

Year	All causes	All diseases	Injuries and poisonings	Communicable diseases		Venereal diseases
				A	B	
1939.....	417	363	54	3	84	98
1940.....	560	511	49	35	223	81
1941.....	391	332	59	13	100	45
1942.....	461	412	49	24	187	31
1943.....	530	480	50	42	203	28
1944.....	392	342	50	15	101	27

FORCES ASHORE

1939.....	422	368	54	4	117	52
1940.....	536	487	49	27	229	52
1941.....	424	366	58	18	126	30
1942.....	510	466	45	30	227	25
1943.....	568	520	48	51	232	25
1944.....	413	370	43	19	116	27

FORCES AFLOAT

1939.....	414	360	54	3	64	126
1940.....	581	533	48	43	219	106
1941.....	354	294	60	7	72	62
1942.....	338	279	59	9	86	45
1943.....	393	335	58	9	101	39
1944.....	339	274	65	6	65	29

NOTES ON OUR RESERVE CONTRIBUTORS

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Christiansen, George W., Commander (DC) USNR (*Bilateral Depressed Fracture of the Zygoma*, p. 153). D.D.S., University of Michigan School of Dentistry, 1917; A.B., Wayne University, 1933; M.S., University of Detroit, 1935. Instructor in dental histology and oral surgery, University of Detroit School of Dentistry, 1934-35; attending oral surgeon: St. Mary's Hospital, St. Joseph's Mercy Hospital, and Evangelical Deaconess Hospital, Detroit, Mich.; consulting dental surgeon, Harper Hospital, Detroit. Fellow: International College of Dentists; Pierre Fauchard Academy; associate fellow American Medical Association; member: American Dental Association; Michigan State Dental Association; Detroit District Dental

Society; American Society of Oral Surgeons (past president); associate member Wayne County Medical Society.

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Durburg, John R., Lieutenant (MC) USNR (*Destroyer Surgery*, p. 171). B.S., Loyola University, 1931; M.D., Loyola University School of Medicine, 1934. Intern, Cook County Hospital, Chicago, 1933–35; resident, Presbyterian Hospital, Chicago, 1935–36; private practice, Chicago, 1935–; clinical instructor, obstetrics and gynecology, Loyola University School of Medicine; attending obstetrician: St. Joseph Hospital, Chicago; St. Francis Hospital, Evanston, Ill. Fellow American Medical Association; member: Illinois State Medical Society; Chicago Medical Society.

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Garland, Leo H., Lieutenant Commander (MC) USNR (*Myocardial Infarction—Roentgen Diagnosis*, p. 89). M.B., B.Ch., B.A.O., University College Dublin School of Medicine, National University of Ireland, 1924. Resident in radiology, Stanford University Hospital, San Francisco, 1926–27; instructor in radiology, 1929–32, and assistant clinical professor of radiology, 1932–, Stanford University School of Medicine; visiting radiologist, St. Joseph's Hospital, San Francisco, 1935–. Fellow: American Medical Association; American College of Radiology (past acting president); member:

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UNITED STATES NAVAL MEDICAL BULLETIN



PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY

VOLUME 45

NUMBER 2



AUGUST 1945

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED 112



COVER PHOTOGRAPH

Aboard a troop transport steaming toward Iwo Jima with an invasion task force, a junior medical officer briefs the ship's boat crews in first-aid practices, demonstrating at this point the use of a battle dressing.

—Official U. S. Navy Photo.

VOL. 45

AUGUST 1945

NO. 2

UNITED STATES
NAVAL
MEDICAL
BULLETIN



MONTHLY

DIVISION OF PUBLICATIONS
BUREAU OF MEDICINE AND SURGERY

Compiled and published under the authority of
Naval Appropriation Act for fiscal year 1946,
Public Law No. 62, approved May 29, 1945

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1945

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
See page II for prices

NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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Volume 19, 1923, Nos. 2 and 3.

Volume 20, 1924, Nos. 2, 5, and 6.

Volume 24, 1926, Nos. 1, 2, and 4.

Volume 25, 1927, Nos. 1 and 4.

Volume 26, 1928, Nos. 1, 3, and 4.

Volume 27, 1929, No. 4.

Volume 28, 1930, No. 1.

Volume 31, 1933, No. 3.

Volume 42, 1944, No. 2.

SUBSCRIPTION PRICE OF THE BULLETIN

Subscriptions should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Yearly subscription, \$4; foreign subscription, \$5.

Single number, domestic, 35 cents; foreign, 45 cents, which includes foreign postage.

Exchange of publications will be extended to medical scientific organizations, societies, laboratories, and journals. Communications on this subject should be addressed to the Surgeon General, United States Navy, Washington 25, D. C.

PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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NOTICE TO CONTRIBUTORS

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Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

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All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

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U. S. NAVAL MEDICAL BULLETIN

VOL. 45

AUGUST 1945

No. 2

SPECIAL ARTICLES

CORD BLADDER

RESTORATION OF FUNCTION BY TRANSURETHRAL OPERATION

GERSHOM J. THOMPSON

Commander (MC) U.S.N.R.

The urologic care of patients with cord bladder is only part of the management of such cases. The importance of cooperation of the neurosurgeon, orthopedist, physiotherapist, urologist, physical training officer, nurses, hospital corpsmen and assistants cannot be overstressed. Few of the paralyzed veterans of this war will remain complete invalids. Neurosurgical procedures to relieve nerve pressure, orthopedic corrective and stabilizing measures, skilled physiotherapy to strengthen muscles and bones, urologic operations which restore voluntary bladder control, and finally a rehabilitation program which overcomes psychic damage will make the majority of these patients self-sufficient.

This article will deal principally with the urologic aspects of the problem. Care of the bladder is the most obvious necessity at the outset. It has been said that through a little understood, if not in fact mysterious mechanism, some of these patients develop an automatic bladder. Few indeed are so fortunate, and these only many months after injury. In fact practically all will require artificial drainage through a tube or catheter. Since the care of such a device is a 24-hour job, the most important point of all is the training of personnel who will be constantly available to see that drainage is maintained. Properly instructed hospital corpsmen do this much more efficiently than does a changing staff of medical officers.

The efforts of the physical training officer and physiotherapist are of paramount importance from the urologic standpoint. Hypercalcinuria can be reversed and calculus formation avoided

by early attention to exercise of the unparalyzed muscles and bony structures of the upper half of the body. At first these patients lie immobile, apathetic and disinterested, and the urine is thick with calcium debris. As weeks go on, they become interested in efforts to correct their inactivity, and with encouragement they quickly develop great strength in their arms, shoulders, and abdominal muscles. The use of spring devices, dumbbells, and arm calisthenics each day under the guidance of a physical training officer is very important. Their improved strength and spirits aid immeasurably in later efforts to walk.

The improved abdominal muscle tone simplifies care of the bowel, for it aids greatly in expulsion of enemas which must be given regularly. Most striking of all is the effect of exercise on calcium metabolism; the bones become normal, hypercalcinuria ceases, and the urine becomes acid and finally is free from abnormal debris. Excess excretion of calcium in the urine can only be prevented by this attention to exercise. Urinary acidifiers or drugs, such as aluminum hydroxide, administered orally to precipitate calcium within the bowel and thus prevent its absorption are, in the experience here, of no value. They not only fail in their purpose but actually cause harmful constipation. An acid-ash diet is also of no value, for it is difficult enough in the early stages to get these patients to eat anything. Large quantities of citrus fruits can be avoided, but no other ban on food need be made.

CARE OF THE BLADDER

In rare instances the cord injury may be minor in degree, and even though paralysis exists, it is one-sided or very temporary in nature, and normal urination is either disturbed not at all or for a very short period. In the vast majority of cases paralysis is so extensive that urination is impossible and remains so for many months. The distended bladder must be emptied, and on the proper methods of doing so depends the life of the patient, otherwise urinary sepsis, renal failure, uremia, and death will result.

In the early phase of the paralysis the bladder of a few of these patients can be emptied by manual pressure applied in the suprapubic region. As time goes on, however, these few usually find that more and more pressure must be applied and that the bladder cannot be completely emptied. Finally infection will develop, for infection follows stasis no matter where in the urinary tract it occurs. The majority of paralyzed patients require drainage of the bladder through a catheter placed suprapubically through a stab wound, through a boutonnière incision in the perineal portion of the urethra, or through the penis. No matter where placed, the

catheter cannot be neglected and must be irrigated regularly and changed at regular intervals.

After a lapse of weeks or months, when the catheter is removed some of these patients develop what is loosely called an automatic bladder. In other words, they void at irregular intervals but are usually incontinent to some degree; hence a urinal of some type must be worn at all times. I have never seen a patient afflicted with a cord bladder who could accurately time the period of automatic voiding, catch the urine as it is voided, and stay dry between times. For this reason drainage by catheter is usually continued indefinitely.

The nursing problem in such cases becomes one of considerable magnitude and the rehabilitation of the patient is greatly complicated by the presence of the catheter. Furthermore there is in these patients considerable psychic damage.

RESTORATION OF BLADDER FUNCTION

If the indwelling catheter can be dispensed with, the patient's condition improves rapidly and in a few months hospitalization is no longer required. This can be accomplished by transurethral operation. It should be emphasized that many months must elapse, however, before attempting any surgical procedure of this sort designed to restore urination. Some patients will have spontaneous recovery of function which is quite satisfactory. But in those patients who are entirely unable to urinate after maximum nerve recovery has taken place, a properly performed transurethral resection of the vesical neck will restore voluntary control of bladder function.

In 1935 Braasch (1) and I described a series of cases observed during the preceding several years, and in a later article (2) Jacobson and I discussed a group of cases in which this operation was done on patients in whom the spinal cord deficiency was due to congenital anomaly. Other articles on this subject have been written by Emmett (3) and by Nesbit and Gordon (4).

In studying the mechanism of urination in these disabled patients, neurologists and physiologists have heretofore viewed the problem strictly from the nerve or muscle standpoint and have overlooked its mechanical aspects. Transurethral resection of the vesical neck does not cure the nerve lesion; neither does it restore the bladder musculature to normal, but it does enable the patient to urinate and to be continent.

The ability to urinate or the lack of it depends upon the balance between the retention mechanism, provided by bladder neck and urethral musculature, and the emptying mechanism, consisting of

involuntary detrusor urinae muscle tone combined with the voluntary power exerted by the abdominal muscles and diaphragm. Cystoscopic examination in these cases, if it is made a number of months after injury, will reveal the previously flaccid bladder wall changed to detrusor muscle fibers which are definitely hypertrophied. Trabeculation and sometimes cellule formation will be noted. Even though the bladder neck appears relaxed, it will be evident on careful examination that the muscle bundles which surround the bladder neck are also thickened. This is especially noticeable on critical examination when the bladder is distended.

In some instances a prominent contraction ring was apparent. It would seem highly probable that the contraction or stiffening of this musculature at the outlet prevents emptying of the bladder. The activation of this muscle may be due to reflex stimulation by distention of the bladder through the mechanism of a local reflex arc confined within the bladder wall itself. Or it could be an entirely mechanical phenomenon due to pull on detrusor fibers which normally sweep down and insert around the neck of the bladder.

Physiologists and anatomists are still in disagreement as to the existence of a true internal urethral sphincter. If, with a cystoscope, one observes the bladder neck in the paralyzed patient on the operating table undergoing laminectomy, it will be noted that stimulation of the uninjured third and fourth sacral nerve roots causes a definite contraction of the muscle in the region of the bladder neck, whereas the remainder of the bladder wall remains immobile. This might or might not indicate the existence of a separate muscle, but it does give some evidence as to which muscle tissue is the more active.

Further evidence that the problem is a mechanical one is provided by recent experience in a series of patients subjected to transurethral operation. The cord injury in these cases was due to spinal fracture or to bullet wounds. These operations were performed exactly as previously described (1) (2). If sufficient tissue is removed from the outlet, and all evidence of spasticity of the sphincteric tissue is eliminated as observed at the time of greatest distention of the bladder, these patients who are unable to void and who have overflow incontinence will be enabled completely to empty the bladder, and furthermore will have good control at all times.

In performing the operation it is important to remove a substantial amount of tissue. The resection of a few pieces from the posterior half of the vesical neck usually accomplishes nothing; as a rule, tissue must be excised from the entire circumference of the outlet. Only in this way can the resistance of the retention mech-

anism be diminished sufficiently so that an increase of pressure within the abdomen, accomplished by straining, will squeeze the bladder dry.

The most gratifying feature of all is that between urinations the patient has perfect control. Depending upon fluid intake, 4 or more hours may elapse between urinations. If fluids are restricted in the evening, the patient can sleep all night, perfectly dry. The boost to the morale of the patient by getting rid of the catheter is remarkable.

CASE REPORTS

Case 1.—A 35-year-old chief pharmacist's mate injured the cervical cord when he fell 11 feet, striking his head. There was paralysis of all four extremities. Three months later the hands and arms could be moved slightly. At the end of 9 months, in spite of spastic quadriplegia, he managed to walk in a walker. Through persistent training, by the twenty-fourth month he could walk fairly well with a cane. He was never catheterized but dribbled constantly, requiring a rubber urinal. During recovery he was taught to express the major part of the urine manually, but 15 minutes of exhausting effort did not completely empty the bladder and dribbling continued. Catheterization revealed 6 ounces of residual urine.

A transurethral resection of the vesical neck was performed 27 months after injury, removing a thickened rim of muscle tissue from the internal urethral orifice. Eighteen pieces of tissue weighing 5 gm. were excised. Sections showed this tissue to be hypertrophied smooth muscle fibers. When the catheter was removed a week after operation, the patient could retain urine fairly well, and at the end of 3 weeks urinated every 90 minutes. Since then he has continued to improve and, 33 months after the injury, can hold from 350 to 400 cc. of urine, voiding only every 3 or 4 hours and keeping perfectly dry in the interim. A peculiar dull ache signals the desire to void, after which he can hold the urine for several minutes, permitting him to walk to the toilet. He goes on liberty regularly, does not bother with a urinal or clamp, and is certain that the operation has resulted in great improvement. The voided urine is microscopically and culturally negative. An intravenous urogram is normal.

Case 2.—A 34-year-old Marine officer suffered a gunshot wound of the cauda equina resulting in immediate paralysis of the right leg and some weakness of the left leg. Exploration of the abdomen revealed a prevesical hematoma; the bladder was opened and found normal. The abdomen was closed without drainage, and a urethral catheter was taped in place.

Two months after injury laminectomy was performed over the fifth lumbar and first, second, and third sacral vertebrae, and a partially organized hematoma removed from this area. Cystoscopy at monthly intervals was done to remove soft stones from the bladder. The typical relaxation noted in cord bladder was observed. The catheter was removed many times but no urine could be passed. On one such occasion, 5 months after injury, 5 milligrams of furmethide was given subcutaneously, causing much flushing, sweating, hypersalivation, and distress in the bladder area, but no urine was passed.

Six and one-half months after injury a transurethral resection was performed and several pieces of tissue from the posterior half of the bladder

neck were removed. When the catheter was next removed, 90 cc. and 250 cc. of urine were voided on two occasions, but then the bladder filled and the patient was unable to void. A second operation was performed, removing tissue from the anterior half of the bladder neck, but only temporary benefit was obtained from this operation.

A third transurethral operation was done, removing 16 pieces of tissue from the entire circumference and widening the bladder neck considerably. One week later, when the catheter was removed, the patient passed urine with little difficulty and catheterization did not yield any residual urine. Ten months after injury the patient was urinating well and had perfect control over this function. The urine was grossly clear and intravenous pyelograms showed negative findings.

Case 3.—A 24-year-old boatswain's mate, second class, suffered a fracture of the first lumbar vertebra when a jeep overturned. X-ray films revealed the vertebra to be dislocated $2\frac{1}{2}$ cm. posteriorly in relation to the twelfth dorsal vertebra. Laminectomy was performed. It was impossible to express the urine, therefore an indwelling urethral catheter was placed. There was paralysis below the waist.

Six months following injury the patient was able to stand with the aid of braces and shortly thereafter could walk with the aid of crutches. Although he could not urinate, it was possible at that time to express the urine by means of strong manual pressure. After a few days, fever and left renal pain developed, and reinsertion of the catheter showed 300 cc. of residual urine.

Nine and one-half months after injury transurethral resection was done and eight pieces of tissue were removed from the posterior two-thirds of the bladder neck. When the catheter which had been inserted postoperatively was removed, the patient urinated well by straining with the abdominal muscles and was perfectly continent. Bleeding from the bladder neck required fulguration and reinsertion of the catheter for 1 week.

One year after injury the patient is able to void from 450 to 500 cc. of urine at one time, and has an excellent stream. Catheterization reveals no residual urine. Control is good and he sleeps all night without voiding. There is no motor power or sensation below the level of the iliac crests; yet, this patient, by virtue of great strength in his arms and shoulders, is able to get from his bed to a wheelchair and back again. He can also walk with crutches with the aid of leg braces. The urine contains from 30 to 40 pus cells per high-power field, and intravenous pyelography shows a stone in the upper calyx of the right kidney.

Case 4.—A 37-year-old line officer fractured his spine at the first lumbar vertebra when he fell 18 feet. Immediate paralysis developed. An indwelling urethral catheter was necessary. He was flown home but because of pneumonia and decubitus ulcers along the spine and sacrum, laminectomy could not be performed until 5 months after injury. Following this operation he was able to move both legs fairly well. No urine could be passed when the catheter was removed, although an overflow dribbling occurred whenever 700 cc. of urine was present. The urine could not be expressed.

Nine months after injury a transurethral resection of the vesical neck was performed and tissue removed from the entire circumference of the neck. This enabled him to void, but too much bladder neck resistance remained, for urination was accomplished only by great straining. More tissue was therefore excised from the entire circumference of the bladder neck and, when the

catheter was removed postoperatively, the patient could urinate with comparative ease and had good control. As much as 500 cc. of urine was passed. At present an intravenous pyelogram shows evidence of normal kidneys and ureters. Catheterization after voiding shows no residual urine. He can walk in a walker with the aid of braces.

Case 5.—A 31-year-old Marine officer sustained a gunshot wound of the spine, suffering paralysis which completely affected the left leg and permitted only slight movement of the right. Roentgenograms disclosed a defect of the left inferior angle of the body of the first lumbar vertebra. Complete retention of urine necessitated the use of an indwelling catheter.

Two months after injury laminectomy was performed which revealed damage of the conus and cauda equina. Catheter drainage was continued. Cystoscopy revealed a typical cord bladder with marked relaxation of the bladder neck, but on distention, spasm of the sphincteric tissues was apparent. The catheter was removed on many occasions but the patient could neither void nor could urine be expressed. Eight and one-half months after injury a transurethral resection was performed and eight small pieces of tissue were removed from the bladder neck. This operation was ineffective, for the patient could not urinate when the catheter was removed.

Additional tissue, weighing 4 gm. was then excised from the entire circumference of the bladder neck, and 1 week later, or nearly 10 months after injury, the catheter was removed, and the patient has since then been able to urinate regularly. Amounts up to 725 cc. of urine have been passed, rapidly emptying the bladder. Control in the intervals between urinations is excellent. There is definite psychic improvement, the patient's appetite is much better, and he is gaining weight rapidly. With the aid of a walker and leg braces he can walk the length of the hall. An intravenous urogram does not show any evidence of abnormality.

SUMMARY AND CONCLUSIONS

The extent of paralysis varied in each of these cases, depending upon the level and severity of injury to the cord. No two cases were exactly alike and the response to treatment and time required to obtain maximum benefit differed considerably.

All of these patients suffered great bladder disability, yet by carefully keeping the bladder empty and as clean as possible at all times, severe cystitis and pyelonephritis were avoided. No patient was permitted to lie with an overflow incontinence or a plugged catheter; this explains the avoidance of febrile reactions.

The formation of urinary calculi was prevented in all but one patient by early attention to the principle of reducing hypercalcinuria through graded exercise of the unparalyzed portions of the body. The normal or better than normal strength of the arms, shoulders and abdominal muscles aided greatly in rehabilitation.

Voluntary bladder function was restored in all of these cases by transurethral resection of the hypertrophied internal sphincter. Prior to operation these patients had suffered with urinary retention and dribbling overflow incontinence; since operation they

have been able to void at will, empty the bladder completely, and have good control.

It seems likely that, through cooperative effort of the neurosurgeon, physiotherapist, orthopedic surgeon, and urologist, the great majority of paralyzed veterans of this war will become self-sufficient and not require permanent hospitalization.

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SURGICAL DON'TS FOR ORTHOPEDIC CASUALTIES

Don't put skintight casts, with or without stockinet on compound fractures. The soft tissue edema will shortly cut off the circulation.

Don't neglect to split completely all skintight casts on simple fractures, down to the last thread of plaster on stockinet.

Don't put on gauze bandages to hold dressings in place under casts; use sheet wadding. Swelling of the part, contraction of the gauze and the hardening of the dressing by blood and serum will impede circulation.

Don't use tension in the application of elastic bandages; they shrink with the moisture of perspiration.

Don't allow shoe traction to stay on any longer than necessary. Pressure ulcers appear later (4 hours maximum).

Don't overextend fractures while patient is in shock or when seen very early. Overextension allows soft tissue to come between the bone ends. The same is true of too strong skeletal traction at any time.

Don't pack through-and-through wounds with through-and-through vaseline strips. Pack from both sides.

Don't pack vaseline gauze too tightly. Such packing increases the danger of secondary hemorrhage and also impedes circulation.—ATSATT, R. F., Commander (MC) U.S.N.R., Retired, and JIVERS, E. H., Lieutenant Commander (MC) U.S.N.R.

ACUTE INFECTIOUS MONONUCLEOSIS SIMULATING ACUTE ABDOMINAL EMERGENCY

REPORT OF FOUR CASES OCCURRING ABOARD SHIP

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The surgical facilities provided aboard modern capital ships are entirely adequate for the performance of all forms of major surgery within the limits imposed by the capability and conscience of the medical officer. However many other factors of vital importance, peculiar to the practice of major surgery at sea, must be weighed before deciding whether or not to operate in a given case. The operation per se is usually of less importance than is the postoperative period.

Conditions are usually far from ideal. If the ship is operating in tropical or semitropical waters, the heat and humidity in the sickbay are usually intense and often intolerable. Rough weather, causing excessive roll and pitch can make a postoperative patient miserable and may seriously impede his recovery. If the ship is operating in a combat area, long periods of the first condition cited add to the hazards, with reduced ventilation, with heat, inadequate nursing care and difficulties in obtaining special dietary items.

Hence the judgment of the surgeon aboard ship is often taxed to the utmost in deciding whether or not to operate, and he is usually justified only in performing major surgery in cases of so-called acute surgical emergencies, of these by far the most common being acute appendicitis. Even here, if doubt exists concerning the necessity of surgery, it has been recommended that a trial of medical treatment with sulfonamides be given in the management of appendicitis aboard ship (1).

During the past 6 months aboard a heavy cruiser having an average complement of around 1,650 officers and men, several cases of acute infectious mononucleosis were encountered. In four of these, most or all of the signs and symptoms were confined to the abdomen and were of such character and severity as to simulate an acute surgical emergency. Two patients presented classic pictures of acute appendicitis, one of an acute diverticulitis

(Meckel's), and one of a perforated peptic ulcer or ruptured spleen.

If the previous occurrence of typical cases of acute mononucleosis accompanied by sore throat and cervical adenitis had not made us "mononucleosis minded," these patients might have been subjected to useless and unnecessary surgery. It is probable that medical officers are too little aware of the fact that mononucleosis involving the mesenteric or retroperitoneal lymph nodes and spleen may simulate other abdominal diseases. Textbooks either fail to mention, or only briefly point out, that "enlargement of the retroperitoneal lymph glands may be responsible for abdominal pain, nausea and vomiting simulating acute appendicitis" (2). Hence we feel that our experience deserves to be brought to the attention of other medical officers, especially aboard ship, since an appendectomy should never be considered a minor procedure at sea.

A detailed discussion of the etiology, pathology, signs and symptoms, and diagnosis of acute infectious mononucleosis is outside the scope of this article. Aboard ship, even with limited laboratory facilities, the diagnosis can be established with a fair degree of accuracy through a study of the blood, providing, of course, that one has the disease in mind. The characteristic picture is a leukocytosis of from 10,000 to 20,000 or higher with a decrease in polynuclears, and with from 50 to 85 percent of the large characteristic cells of the lymphocytic group. However a leukocytosis is not the rule in the initial stages of the infection, and even a definite leukopenia may be present. Nevertheless with the onset of symptoms the typical change in the differential count is already present, irrespective of the total leukocyte count.

The predominating cell is a lymphocyte, a varying number of which are abnormal, showing deeply basophilic staining cytoplasm containing coarse granules, and with cytoplasmic vacuoles causing a foamy appearance. The presence of these so-called "mononucleosis cells" is considered by most authors almost a pathognomonic sign. The presence of heterophile antibodies in the patient's serum, agglutinating sheep red blood cells (the Paul-Bunnell test), is confirmatory. However facilities for performing this test are not available aboard ship.

Since the underlying pathosis in this disease is an acute hyperplasia of lymph nodes, and since lymph nodes have such a widespread distribution in the body, it becomes clear why, as Bernstein (3) observes, on a modest scale infectious mononucleosis may be said to resemble syphilis in its ability to simulate other diseases. As the disease is self-limited and carries no mortality risk, it would be most unfortunate to subject a patient to a laparotomy

at sea through failure to recognize the presence of mononucleosis as the cause of the patient's abdominal complaints.

It is of interest to consider the question of why patients with mononucleosis involving the abdominal and retroperitoneal lymph nodes should have so much pain and tenderness, since lymph nodes and their capsules possess no sensory nerves. The only nerves present are those entering the hilus, accompanying the blood vessels, and they are probably vasomotor (4). However it is an established observation that enlarged retroperitoneal lymph nodes from whatever cause are quite tender to deep abdominal palpation, and produce varied subjective abdominal pains.

Desjardins has pointed out that one of the earliest and often the only sign of retroperitoneal lymphoblastoma or lymphosarcoma is vague abdominal pain with tenderness to deep abdominal palpation. It is probable that pressure on adjacent structures is the source of these complaints. Two of our patients suffering from mononucleosis volunteered the information that they obtained considerable relief from pain by sitting up and leaning forward, or lying in the prone position, this apparently removing the weight of the overlying viscera on the enlarged nodes.

The following four cases of acute infectious mononucleosis occurring aboard ship illustrate the various types of abdominal pain encountered here.

CASE REPORTS

Case 1.—A Navy officer, age 26 years, was suddenly seized with pain in the upper abdomen. The pain was severe, sharp, and steady in character and soon moved to just left of the umbilicus. Physical examination revealed a well-developed male in evident distress. The temperature was 98.2° F., pulse rate 97, and respirations 20 per minute. A moderate amount of generalized abdominal rigidity was present and tenderness in the midepigastrium with moderate tenderness just to the left of the umbilicus on deep palpation. The patient experienced some relief on sitting up and leaning forward and upon lying on his abdomen. No regional lymph nodes could be palpated. The urine was normal. Blood count showed 9,800 leukocytes with 1 percent band forms, 32 percent segmented cells, 62 percent lymphocytes, and 5 percent monocytes. A large number of lymphocytes were abnormal, showing deeply basophilic cytoplasm often containing vacuoles.

The abdominal pain began to subside in 12 hours and after 24 hours only slight tenderness could be elicited on deep palpation, but a feeling of weakness continued for 7 days. After 90 days the erythrocyte count was 4,620,000 and the leukocyte count 5,200 with a differential count of 1 percent band forms, 48 percent segmented cells, 41 percent lymphocytes, 3 percent monocytes, 6 percent eosinophils and 1 percent basophils.

Case 2.—A chief boatswain's mate, age 36 years, reported to sick call, stating that for 3 days he had had a cramp-like pain in the lower part of the abdomen accompanied by nausea and anorexia. The patient's temperature

was 100.2° F., pulse rate 84, and respirations 20 per minute. There was moderate spasticity of the right rectus abdominis muscle, with well localized tenderness on palpation over McBurney's point and also in the left upper quadrant of the abdomen. No regional lymph nodes were palpable. Forced extension of the right leg caused pain in the right lower abdominal quadrant. This patient also experienced relief on lying upon his abdomen or upon leaning forward. The findings indicated a diagnosis of acute appendicitis.

The urine was normal. The leukocyte count was 6,800, having a differential count of 1 percent band forms, 55 percent segmented cells, 41 percent lymphocytes and 3 percent monocytes. More than 50 percent of the lymphocytes were abnormal, showing deep basophilic cytoplasm which frequently contained vacuoles.

The abdominal tenderness and pain continued for 2 days and then began slowly to subside. No medication was given and at the end of the fourth day, the patient had no complaints, and the temperature, pulse and respirations were normal.

Ninety days after onset the erythrocyte count was 5,100,000, and the leukocyte count, 5,500, having a differential count of 1 percent band forms, 40 percent segmented cells, 55 percent lymphocytes, and 4 percent monocytes. The lymphocytes revealed a tendency toward deep basophilic cytoplasm with vacuoles.

Case 3.—A seaman, second class, age 20 years, was suddenly seized with a dull cramp-like pain in the right lower quadrant of the abdomen which became worse on movement and exercise and was accompanied by nausea. He also complained of frequency of urination.

The temperature was 99.6° F., pulse rate 86 and respirations 20 per minute. There was moderate spasticity of the right rectus abdominis muscle, acute tenderness over McBurney's point on palpation, and a moderate amount of rebound tenderness. There was no kidney tenderness and the patient was relieved of pain by being on his abdomen. The findings were typical of acute appendicitis.

The urine was normal. The leukocyte count was 8,200, with 1 percent band forms, 41 percent segmented cells, 50 percent lymphocytes, 6 percent monocytes, and 2 percent eosinophils. The lymphocytes showed characteristic deep basophilic cytoplasm with vacuoles.

The pain began to subside in about 24 hours but was followed by great weakness lasting for 10 days. The patient was discharged to light duty on the eighth day of the disease. At no time was any medicine administered except some sodium bicarbonate.

Ninety days later the erythrocyte count was 4,500,000, the leukocyte count 5,300, and a differential count showed 1 percent band forms, 50 percent lymphocytes, 46 percent segmented cells, 1 percent monocytes, and 2 percent eosinophils.

Case 4.—A machinist's mate, third class, age 22 years, was suddenly seized with sharp, generalized abdominal pain shortly after arising in the morning. The pain which was most marked in the left upper and right lower quadrants of the abdomen, was very severe. He also complained of pain in the left shoulder, and nausea.

Physical examination showed the patient to be acutely ill, in severe pain and mild shock. The temperature was 99.4° F., the pulse rate 96 and the respirations 26 per minute. Heart and lungs were normal. There was acute

upper abdominal rigidity with exquisite tenderness over the entire abdomen. The clinical picture suggested an acute perforation of a peptic ulcer, or a ruptured spleen.

A flat plate x-ray film of the abdomen showed no evidence of free gas in the peritoneal cavity. There was a large homogeneous soft-tissue mass in the left upper quadrant of the abdomen, slightly elevating the left diaphragm, which was interpreted as being an enlarged spleen. The leukocyte count was 18,900, with 1 percent band forms, 38 percent segmented cells, 52 percent lymphocytes, 6 percent monocytes, and 3 percent eosinophils. Numerous lymphocytes showed basophilic cytoplasm with vacuoles.

A diagnosis of acute infectious mononucleosis was made, and preparation for immediate surgery was cancelled. The pain was sufficiently severe to require morphine for control during the first 48 hours, when it began gradually to subside. The abdomen remained very tender for 2 weeks, after which only splenic tenderness remained. The spleen was palpably enlarged for 6 weeks.

Ninety days after onset the hemoglobin content was 85 percent, the leukocyte count was 9,500, and the differential count showed 3 percent band forms, 51 percent segmented cells, 42 percent lymphocytes, 3 percent monocytes, and 1 percent eosinophils. Many lymphocytes still showed basophilic foamy cytoplasm.

COMMENT

The one reliable aid in differentiating the true condition from some surgical emergency, present in all our cases, was the presence of from 50 to 70 percent lymphocytes in the differential blood count, despite a leukocytosis ranging up to 20,000. This represents a complete reversal of the usual "shift to the left" of the blood count in acute inflammatory abdominal conditions, such as appendicitis. Other findings that seem to be peculiar to mononucleosis involving abdominal nodes include poorly localized but marked tenderness through the entire abdomen and occasionally a palpably enlarged, tender spleen. Evidence of parietal peritoneal irritation is vague. Typical rebound pain is usually absent. Splinting of the abdominal wall muscles may be prominent, but it appears to be more voluntary than reflex.

If the possibility that a patient suffering abdominal pain of acute onset may have acute infectious mononucleosis is borne in mind, the diagnosis can be made and an abdominal operation avoided by one or more accurate differential blood count studies. It is probably safe to say that, in the presence of an acute abdominal emergency, if the patient has a leukocytosis with 50 percent or more lymphocytes, it is not an acute inflammatory disease requiring surgery.

All of our patients experienced a prolonged period of weakness and prostration after the acute symptoms had subsided, which was out of proportion to what would be expected from the mildness and short duration of the febrile period. Further a series of blood counts made 3 months after the onset of the acute illness showed,

in all cases, a tendency toward an abnormally high lymphocyte count, and numerous characteristic "mononucleosis cells" were still present.

CONCLUSIONS

1. Acute infectious mononucleosis involving the abdominal and retroperitoneal lymph nodes may cause symptoms simulating an acute condition of the abdomen requiring immediate surgery.

2. The differential diagnosis depends principally upon the differential leukocyte count.

3. If the disease is kept in mind, unnecessary surgical operations may be avoided.

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USEFULNESS OF ESTROGENS AND ALUMINUM GELS IN RENAL STONES

Estrogens (estradiol benzoate) and aluminum hydroxide gels, by bringing about specific alterations in the chemical composition of the urine, have proved valuable in the management of renal stones of calcium phosphate, calcium carbonate, magnesium phosphate, magnesium-ammonium phosphate, and calcium-magnesium-ammonium phosphate composition.

The rationale for their use rests on the concept that estrogens, by increasing urinary citrate excretion, reduce the concentration of the calcium ions participating in the precipitation of calcium phosphate, replacing them with a weakly ionized soluble calcium-citrate complex. Aluminum hydroxide gel by diverting phosphate excretion from the urinary to the intestinal tract, reduces the number of phosphate ions participating in the same reaction. A combination of both these measures should provide considerable protection against precipitation of calcium phosphate, even at alkaline ranges of urinary pH; and in the acid range should lead to appreciable undersaturation with respect to calcium and phosphate ions.—SHORR, E.: Possible usefulness of estrogens and aluminum hydroxide gels in management of renal stone. J. Urol. 53: 507-520, April 1945.

INGUINAL HERNIORRHAPHY

FOLLOW-UP REPORT

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Inguinal herniorrhaphy is the most common major surgical operation performed in Naval hospitals and yet follow-up study is completely neglected. As the surgeons of World War I debated the value of a particular type of repair, so also the surgeons of this war continue the same dispute. While one type of repair, or use of a certain suture material, is advocated by a surgical staff at a service hospital, the same method is contested by another well-qualified group. While one clinic favors a fascial repair, another claims that results with this procedure are unsatisfactory.

It is not the purpose of this article to advocate any particular type of repair or to set forth the arguments of the various sides, but rather to suggest that in the Navy, advantage should be taken of the thousands of herniorrhaphies performed annually to undertake a more careful follow-up study. The majority of reports in the current literature indicates a follow-up series of only a few hundred cases. Within a few years in the Navy, however, a series of thousands of cases could be made available for study. From such a series definite conclusions could be drawn.

Because this operation occupies so much surgical time and is of such military value, it is of practical importance to know which procedure gives best results.

It is suggested that two forms be used and the report sent to the Bureau of Medicine and Surgery, where the statistics can be readily compiled and made available.

FORM 1.—*Herniorrhaphy Follow-Up Report*

Part A.

Name of patient..... Age..... Rate..... Serial No.....
Date of operation..... Place of operation.....
Type of hernia found.....
Was a sac found?..... Was it removed?.....
Describe operative repair.....
.....
.....
Type of suture material used.....
Anatomic structures (poor, fair or good).....
(Signed).....

Surgeon

The first form (Form 1) should be used by the operating and the ward surgeon. The operating surgeon fills out the first report (A) at the time of the operation, when he normally would be dictating his operative procedure. The second part (B) is filled out by the ward surgeon when he discharges the patient and closes out the case. It is realized that a short form will assure more cooperation.

The presence of a hernial sac is of concern, as recurrence may be due to a sac which at a previous operation had not been removed. Dissection of the sac from its covering must be complete, otherwise the stump will be an easy starting point for another hernia.

In describing the operative repair it is important that the type of procedure be given in detail. If a surgeon merely states the name of the procedure, as Bassini, Ferguson, or Halsted operation, it will not be free from qualification, since so many modifications are practiced. The surgeon should particularly include his method of dealing with the transversalis fascia. The detailed surgical description will be the vital aid in this series.

Estimation of the suture material employed may materially determine the issue regarding absorbable or nonabsorbable sutures. Concerning the quality of the anatomic structure, perhaps the surgical dictum "A good suit needs a good tailor and good goods" will be applicable. Certainly a good surgeon is needed, because faulty technic accounts for a proportion of failures. Surgeons must accept the fact that the operation is difficult and calls for all their skill and patience. However the type of operation as applied to the structure present may be responsible for failure.

This first form then accompanies the patient to the ward, and at the time of his discharge the second part is filled out by the ward surgeon.

FORM 1.—*Herniorrhaphy Follow-Up Report*

Part B.

Number of days patient was confined to bed.....
 Number of days in hospital postoperatively.....
 Complications

 Any evidence of recurrence.....
 (Signed).....

Ward Surgeon

The determination of the number of days a patient is confined to bed may aid in evaluating the argumentative issue concerning

whether a patient may be allowed out of bed on the first post-operative day, as advocated by some, particularly those using nonabsorbable suture material, or must be kept supine for from 14 to 21 days postoperatively, as almost universally practiced up to the present time.

Complications, such as excessive coughing, atelectasis, or wound infection also may have a definite bearing on the causation of a recurrence.

At the time of the patient's discharge, when the health record is being filled out, the second report in the form of a mailing card is attached. This form reports the results of a physical examination made 2 years or more after the operation. Instructions should direct the examining officer not to complete the form under 2 years following the operation, unless a recurrence is seen earlier. This is based on Erdman's¹ report that over half of the recurrences are apparent within 6 months, nearly 80 percent within 1 year, and about 90 percent before the lapse of 2 years. Reliable follow-up reports must be based only on those patients who have been followed for 2 years and have actually been re-examined.

FORM 2.—*Herniorrhaphy Follow-Up Report*

(Note: Return in 2 years or more after operation)

Name..... Rate..... Serial No.....
Date of herniorrhaphy.....
Time interval between operation and resumption of active work
.....
Complications
Evidence of recurrence.....
(Signed)
Medical Officer

The medical officer should be admonished to conduct a most careful examination. A small recurrent herniation may be quite elusive. Such a sac may be demonstrated by the preliminary jumping, coughing, straining, or squatting of the examinee, or by finger pressure downward over the inguinal canal. One of these methods may help to elicit the sac when all the others fail. Frequently coughing alone does not bring down a sac. In such an instance it is surprising how often one of the other methods will demonstrate a sac. Straining especially is helpful in revealing a hernia. Straining produces maximum muscle play and is associated with a more prolonged intra-abdominal pressure than coughing.

¹ ERDMAN, S.: Inguinal hernia in CHRISTOPHER, F., Textbook of Surgery by American Authors. 3d edition. W. B. Saunders Company, Philadelphia, 1942. pp. 1367-1368,

Complications which are to be noted at the follow-up examination include atrophy of the testis, hydrocele, displacement of the testicle from the scrotum to the inguinal canal and sinuses resulting from nonabsorbable sutures.

All recurrent hernias which are operated should also be reported and then followed in a similar fashion. In describing a recurrent herniorrhaphy the following data should be recorded:

1. The type of recurrence found at operation, including its description.
2. A detailed account of the type of repair performed.
3. The surgeon's opinion regarding the causation of the recurrence.

This report should be appended to the first form.



SURGERY, CHEMOTHERAPY, AND WOUND INFECTION

In an investigation of 1,000 wounds during the battle for the Gothic Line, the organism of initial sepsis was found to be *Staphylococcus pyogenes aureus*. The incidence of infection in wounds before operation at the casualty clearing stations was about 51 percent.

In wounds undisturbed during transit, and treated at the casualty clearing stations by operation alone, 49 percent were infected and 23 percent were septic; by operation and sulfanilamide powder, 25 percent and 7 percent, when examined in the base hospital from 5 to 10 days later. Thus operation alone did not completely remove infection from a recent wound. Its effect was to leave the wound in the best possible condition for dealing with the infection that remained. Sulfanilamide applied locally had a bacteriostatic effect; for although the infecting bacteria persisted, their activity was depressed, so that the incidence of sepsis was reduced. Penicillin-sulfathiazole powder similarly applied was more effective, for its use was followed by the destruction of the infecting cocci in about one-half of the infected wounds, with an equally low incidence of sepsis.

Wounds operated upon at the casualty clearing station in under 12 hours had a lower incidence of infection than those operated upon between 12 and 24 hours, in all the chemotherapy groups. The length of time between wounding and arrival at the base hospital was found to make no significant difference in the infection rate.

Wounds that had been re-dressed between casualty clearing stations and base hospital had a higher incidence of infection than had those that had not been disturbed.—BENTLEY, F. H., and THOMSON, S.: Control of infection in recent wounds by surgery and local chemotherapy. *Brit. M. J.* 1: 471-474, April 7, 1945.

FILARIASIS: HISTOPATHOLOGIC STUDY

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Filariasis as a disease entity in this country has in the past chiefly interested tropical disease workers and certain individual investigators, as the late F. W. O'Connor (1), whose contributions have been of inestimable value. Small endemic areas such as Charleston, S. C. and the Puerto Rican settlements in New York City, have been centers of interest.

The disease has generally been thought of in connection with elephantiasis or other sequelae seen in tropical endemic areas. The present war, however, has focused attention on filarial infestation in its early stages of lymphadenitis and lymphangitis. Tropical lymphangitis occurring in Marine troops and Navy personnel stationed in certain endemic areas of the South Pacific has created a problem of military and medical importance.

After several months' duty, numerous men stationed in that area began to exhibit localized, painful, red, swollen areas of the extremities accompanied by a retrograde type of centrifugal lymphangitis, with or without epididymitis, orchitis, or hydrocele. These objective findings were associated with constitutional symptoms of general malaise, mild fever, nausea, headache, and mild photophobia. Episodes of this nature would last from a few hours to several days, when they appeared to improve or clear spontaneously, only to be followed in weeks or months by subsequent relapses, often following overactivity or physical strain. Blood smears for parasites were repeatedly reported as negative and other laboratory findings were not significant.

Because of the inability at first to establish a proven diagnosis in these patients, medical officers in the areas were naturally somewhat concerned. Their problem was one of diagnosis, prognosis, treatment, and the possibility of dissemination to other Marine troops, as well as to the civilian population on the mainland. A Filarial Control Board was created to make a systematic and comprehensive study of the problem, including laboratory investigation, skin tests, nature and spread of the disease, and means of combating it (2).

In the late autumn of 1942 mature, gravid, female forms of *Wuchereria bancrofti* were definitely demonstrated in lymph node

tissue removed for biopsy (3). Since that time considerable information has been gained through this method of study.

BIOLOGIC CONSIDERATIONS

Microfilariae of *Wuchereria bancrofti* range from 200 to 300 microns in length and from 7.5 to 10 microns in diameter. They are enclosed in a pale delicate sheath which extends beyond both the head and tail of the filaria. The column of nuclei extends from a point approximately 10 microns distal to the sheath head and ends approximately 20 microns proximal to the tail end of the sheath. At the junction of the anterior and middle third of the column of nuclei is the neural ring which appears as a tangential clear space. Slightly distal to this is the excretory pore or V spot. The genital cells 1, 2, 3, and 4 are proximal to the anal pore or tail spot. There is a greater distance between g1 and the small g2 cell.

Adult worms are delicate, threadlike nematodes, white in color, and varying in length from 40 mm. for the male to 90 mm. for the female, and from 0.10 to 0.25 mm. in diameter. Man is the known definitive host, and numerous species of aëdes, anopheles, and culex have been reported as capable of developing infective larvae. The intermediate host in Polynesia, where the author's cases were observed, is *Aedes pseudoscutellaris* (4) (5).

The mosquito probably causes a concentration of microfilariae at the site of the bite by the action of its salivary secretions. The first step is a dissolution of the sheath in the gut of the mosquito. In approximately 6 hours after ingestion, the microfilariae penetrate the gastro-intestinal wall and localize in the thoracic muscle, where two metamorphic changes take place. The infective larvae become mature in approximately 2 weeks (average) and migrate to the proboscis, and are then capable of developing into adult worms in man.

The larvae of *Wuchereria bancrofti* are lymphotactic in character. That is, after the infective microfilariae are deposited upon the skin, they are attracted through the mosquito bite wound by the exudation of lymph. From here they penetrate through the superficial lymphatics to the peripheral lymph channels and lymph nodes, where they develop and mature. In these tissues mating and parturition take place, the worms being larviparous.

Histopathologic changes in the lymphangitis stage of filariasis may roughly be classified in two main divisions:

1. Those presumably due to a generalized sensitivity caused by a distant worm focus with tissue changes occurring on an allergic basis.

2. Those due to the presence of the worm in situ, resulting in local changes from absorption of worm products, and, to a lesser degree, lymphatic obstruction.

ALLERGIC MANIFESTATIONS

A discussion of the lesions observed under the first classification involved certain controversial points which at this time must remain unanswered. Proof in part of this process, however, may be seen in the study of tissues removed for biopsy at the height of the so-called allergic process.

"Fugitive swellings."—These are raised, red areas of the skin commonly seen on the extremities, especially the arms and forearms. They are fleeting, lasting usually but a few hours and when they recede leave few or no residual findings. They may be slightly painful and tender to pressure and are not unlike the lesions seen in erythema multiforme. They are not to be confused with the red streaks of centrifugal lymphangitis occurring in the course of an ordinary exacerbation, or the raised, swollen lymph nodes with rubor of the overlying skin.

Microscopically these lesions show vascular engorgement with edema. There is some perivascular round cell infiltration involving both lymph and blood channels. Eosinophilic cells are fairly numerous and there is usually some endothelial cell hyperplasia. Parasites are not observed. These lesions may precede, accompany, or follow an attack of lymphangitis. They do not seem to be affected by epinephrine.

Skin tests.—The importance of intradermal testing with extract of the dog filaria, *Dirofilaria immitis*, has not yet been completely evaluated. The efficacy and reliability of this test cannot be fully discussed in the present paper, but these factors have been considered in other publications (2) (6) (7). The degree to which a "mumu" patient reacts to this antigen, however, lends support to the sensitivity phenomenon. Immediate and delayed positive reactions may be considered presumptive proof of the disease in those patients not harboring other nematodes. Biopsy of these areas at the height of the delayed reaction (approximately 24 hours) showed a microscopic picture very similar to the "fugitive swellings." In addition, however, the epidermis presented edema and some round cell infiltration. Eosinophilic cells were present in the cutis and vascular channels were generally engorged. Quiescent mumu lesions elsewhere in the body are generally activated—such as swelling of the spermatic cords, reappearance of lymphangitis streaks in other extremities, and swelling of distant lymph nodes. These phenomena are usually more significant than the local skin reaction, and may persist for

from 36 to 48 hours, depending upon the degree of activation.

Lymphatic engorgement.—All lymph nodes or lymphatic channel enlargements are not necessarily due to the presence of the parasites in those particular areas. The actual basis for lymphangitis and lymph node swelling has not definitely been established. The various possible causes will be discussed later. One type of lymph node swelling, however, may be discussed under this heading. Not infrequently during a flare-up of lymphangitis, for example in one extremity, the patient will experience enlargement of lymph nodes in the neck, groin, axilla, or in other areas. Removal of these distant nodes at the height of the swelling and study by serial sections will usually fail to reveal the presence of any parasites. Instead the node will show marked hyperplasia, eosinophilic cell infiltration, and large lakes of homogeneous, albuminoid fluid in the lymph sinuses. The general architecture of the node will be preserved. Unquestionably this demonstrates a selective lymph node sensitivity to worm or worm products located elsewhere in the body.

Genital lesions.—As filarial involvement of the genitals is a common occurrence, it is logical that sensitivity reactions should occur in these tissues. In subjects who have lived in endemic areas and who have been exposed to repeated filarial infections, enlargement of the testes and cords, with hydrocele, is extremely common. Maturing male and female worms lodge in these tissues and initiate specific reactions with destruction of the parenchymatous elements, often resulting in pendulous scrotal enlargements and elephantiasis.

Although maturing male and female filariae may possibly have lodged in these areas in the early stages of lymphangitis in the patients under investigation, there were numerous instances in which complete section of the tissues showed only tissue sensitivity changes without parasites. An example is the following case.

Case report.—A Marine gunner, age 50 years, was evacuated from Samoa because of coronary artery disease, and died from this cause some weeks after arriving on the mainland. He had been in a virulent endemic area for 12 months and had had filariasis for 4 months before evacuation. He had a bilateral funiculitis and orchitis, and a lymphangitis of the left arm with a history of several flare-ups.

Necropsy was performed and detailed studies made on the lymphatic system and the genitals. Degenerating worm segments were seen on section of lymph node tissues involving the upper extremities. The testes, epididymides and cords were then studied according to the O'Connor (1) technic. Both testes and cords were enlarged and appeared edematous, the right testis measuring 8 by 5 by 4 centimeters and the left 7 by 5 by 4 centimeters. Because of the large size of these tissues, each side required 47 blocks which were cut serially.

On gross inspection the tissues appeared pale and edematous, and rather

firm in consistency. On microscopic examination no parasites were observed. There was a proliferation of lymph channels in the cord and tunica albuginea, especially the anterior cord lymphatics. In these areas the surrounding tissues were edematous and pale. Instead of a true lymphangitis, there was a perilymphatic exudation of round cells, with some scattered eosinophils. The lining endothelium of the lymphatics was flattened, intact, and not stratified, with no apparent desquamation.

Tubules in the epididymides appeared distended with spermatozoa, suggesting the possibility of stasis and partial obstruction due to swelling and edema of the cord. The interstitial tissues of the epididymides were not remarkable. The enlargement of the testes, however, was due to edema of the interstitial supporting tissues with a few eosinophilic cells in the stroma. The tubules were normal, lined by intact epithelium with normal spermatogenesis. Necrosis, degeneration, and atrophy were not present. The vas deferens on each side was normal.

It is not presumed that the foregoing case report is representative of all genital enlargements due to filarial infestation. Actual data on these patients are meager, but an example such as this should lend support to the thesis that many of the enlargements are toxic or allergic in nature and not due to the direct invasion of the parasite in the involved organs. These genital lesions, therefore, are generally presumed to be reversible, and normal tissue integrity should be reassumed. Sterilization would not seem to be a permanent complication should it occur. So far as can be determined, secondary sex changes have not been reported, even though the interstitial tissues of the testes are the seat of the main reactions.

In evaluating the allergic basis of many of these reactions the following points should be taken into account: (1) The transitory nature of the lesions; (2) similarity of the lesions to those seen in skin testing with *Dirofilaria immitis* antigen; (3) inability to demonstrate microfilariae or worm segments in the tissues; (4) the presence of edema accompanied by vascular stasis; and (5) the eosinophilic cell response.

Eosinophils in the tissues do not necessarily indicate an allergic lesion, especially when they also occur in large numbers in most parasitic diseases. As a matter of fact, in *Wuchereria bancrofti* lesions, eosinophils are profusely scattered throughout the tissues of the host, and are frequently seen in closely packed collars around the worm segments. Their presence in distant foci, far removed from lesions containing the worms, however, may be considered only as probable evidence of the allergic factor in this process.

PRIMARY PARASITE REACTIONS

These are seen in lesions in which worm segments, living worms, degenerated and calcified forms, or microfilariae are found.

Although many points still remain unanswered when studying infected tissues from filariasis patients, data have been accumulated from which certain deductions can be drawn regarding the course, prognosis, and eventual outcome of these filariasis lesions.

As the microscopic picture differs somewhat according to the location of the biopsies, these changes will be considered according to whether the specimens were removed from lymphatic channels or lymph nodes.

Lymphatic channels.—The cordlike, thickened, raised lymphatic channels are usually the most productive of positive results in biopsy studies. The patients in this series were seen from 4 months to 22 months after exposure, and the symptoms of disease ranged from 2 months to 14 months. Because of this wide time variation it was possible to establish some sequence in the evolution of the lesions.

In the early stages of development, after the infective larvae have been deposited in the deeper lymphatics and begin their growth, the endothelium shows irritative responses. It becomes thickened and thrown into folds. As the worm develops and adolescent forms are established, the endothelium becomes stratified and the lumen of the vessel is gradually narrowed. As the worm matures and lies within the lymph vessel, it assumes a loosely coiled form and the surrounding soft tissues appear to take on a serpiginous outline.

The future course of development depends upon certain factors; namely, whether the worm is a male or female, and whether both are in juxtaposition for gravidity to occur. An isolated male or female worm is presumed to undergo degenerative changes in a relatively short time (in from 2 to 6 months), and the symptoms of lymphangitis occurring in a patient after a short incubation (symptom-free) period are due to degenerative changes in these worms with liberation of products of protein breakdown.

Signs of lymphangitic obstruction in these instances are not pronounced. The wall of the channel may be thickened and edematous, with fibroblastic and eosinophilic cell infiltration and perilymphangitis, but the lumen itself is patent. At this time sensitivity changes may also be evident, such as some of the allergic lesions previously described occurring elsewhere in the body. The number of attacks, the severity of the lesions, and the probability of relapses are due to the rapidity of the tissue changes and extent of protein absorption, as well as the number of such worms undergoing similar degenerative phenomena in various parts of the body.

When, however, male and female worms are located in tissues

in apposition, and gravidity occurs, the symptom-free period may be prolonged because of biologic conditions and variations. First, the lymphangitis may appear with parturition of the gravid female and liberation of microfilariae into the tissues and lymphatics. Secondly, gravidity may occur and lymphangitis be due to degenerative changes taking place in the smaller male worm (early) or the gravid female (later), with liberation of the products of the worm or worms. Finally the gravid female may undergo degeneration before parturition occurs, liberating microfilariae in the tissues. These changes may be traced through a careful study of biopsy specimens.

The presence of filarial worms in the lymphatic tissues calls forth a response by the reticulo-endothelial system.

As the degenerative process of the worm ensues, stratification and thickening of the endothelium become pronounced. The wall of the lymph vessel becomes thickened due to proliferation of granulation tissue. Lymphatic varicosities occur in the neighborhood of the main lesion, with development of a collateral circulation, and the lumen of the main channel is gradually replaced by granulation tissue.

When the worm itself undergoes degeneration, its death is followed by calcification. This calcification is first seen in the central part of the worm and proceeds peripherally, attacking the cuticle last. A zone of necrotic tissue surrounds the worm, and gradually there is an invasion by fibroblasts, macrophages, endothelial cells and giant cells. Fragments of the dead worm are engulfed in the giant cells. Eosinophilic cells in these lesions gradually decrease in number, and as the scar tissue becomes more mature they may almost disappear. The end-result, so far as these studies are concerned, is a fibrous, hyalinized mature scar with few residual indications of previous parasitism.

Lymph nodes.—The lesions seen in lymph nodes differ somewhat from those seen in lymphatic channels. Many of the histologic criteria are common to both, but the possibilities of filariae existing in a viable state are greater in nodes than in lymphatic channels. This is partially due to mechanical factors and lymph circulation. It is not difficult to explain or understand degenerative changes taking place in the channels, with proliferation of fibrous tissue in the wall, gradual obliteration of the lumen, and finally the loss of lymph as a source of nourishment.

In nodes, however, the process is less rapid, and the afferent lymphatics, although partially blocked, respond by the formation of varicosities and collateral channels, thus maintaining a certain food supply to the parasite. For this reason living worms are

more likely to be found here than in the lymph channels.

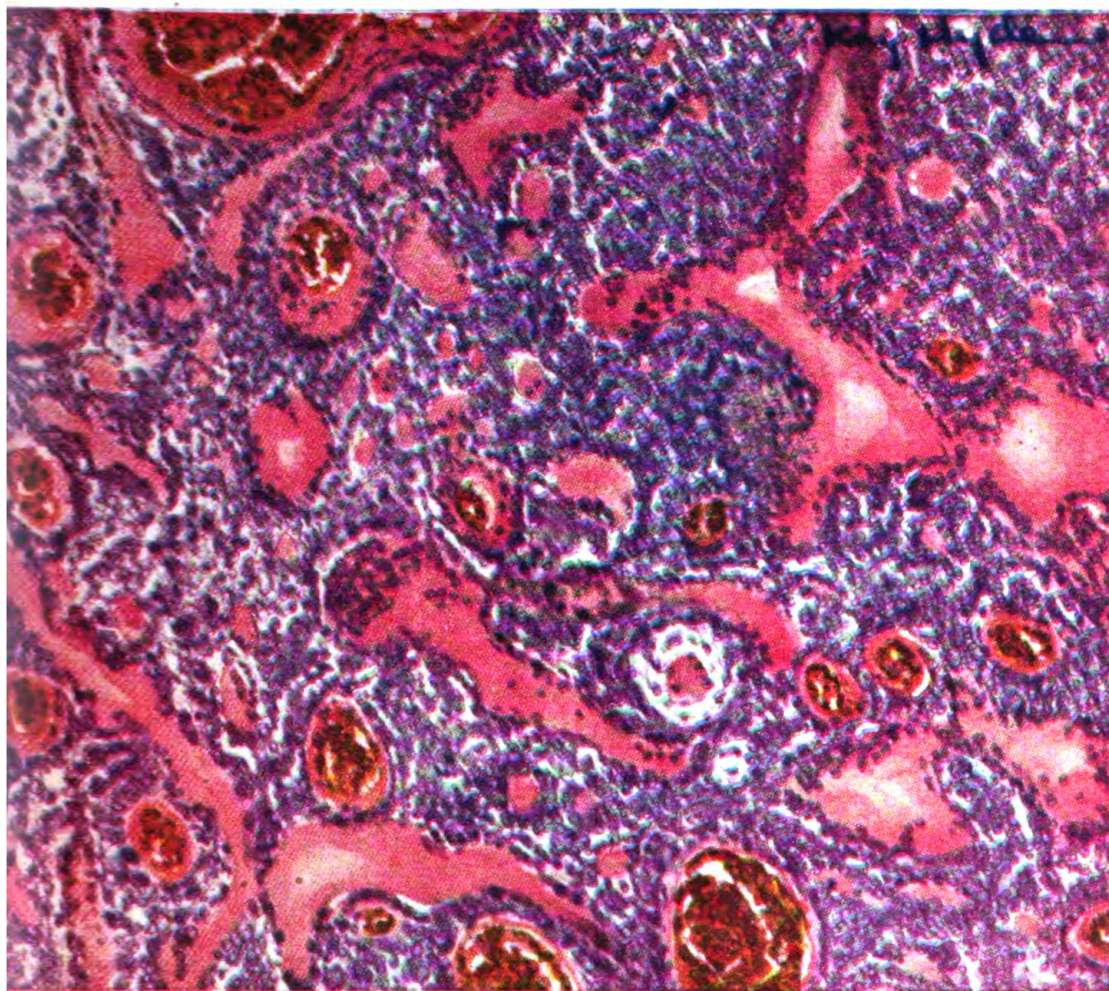
In studying the development of the parasite within a lymph node and tracing the tissue responses of the surrounding lymphatic tissues, the sex of the worms must be distinguished. As in the lymph channels, the growth, development and maturation of the worm depends upon the presence of male and female worms in adjacent tissues. A lone male or female will show, as a rule, degenerative reactions in from 2 to 6 months, and the tissue changes (both local and general), are dependent upon degeneration, tissue breakdown and absorption of the products of the worm. On the other hand when a male apposes a female and gravidity ensues, the symptom-free period may be prolonged, with symptoms developing as a result of liberation of microfilariae, or eventual degeneration and death of the worm and the products of the gravid uterus. The male worm, however, may initiate clinical symptoms in the host earlier by the absorptive changes occurring with its degeneration.

Regardless of the sex of the worm, however, the first manifestation of parasitism within a node consists of edema. Large lakes of lymph can be seen in the sinuses and lymph spaces. As the larva develops there is a massive production of eosinophilic cells, both polymorphonuclear and mononuclear. These are seen in dense zones about the parasite, as well as in the sinuses, pulp, and even the node capsule. There is a progressive proliferation of littoral cells of the sinuses. Lymph follicles become hyperplastic, with an increase in mitotic figures in the germinal centers.

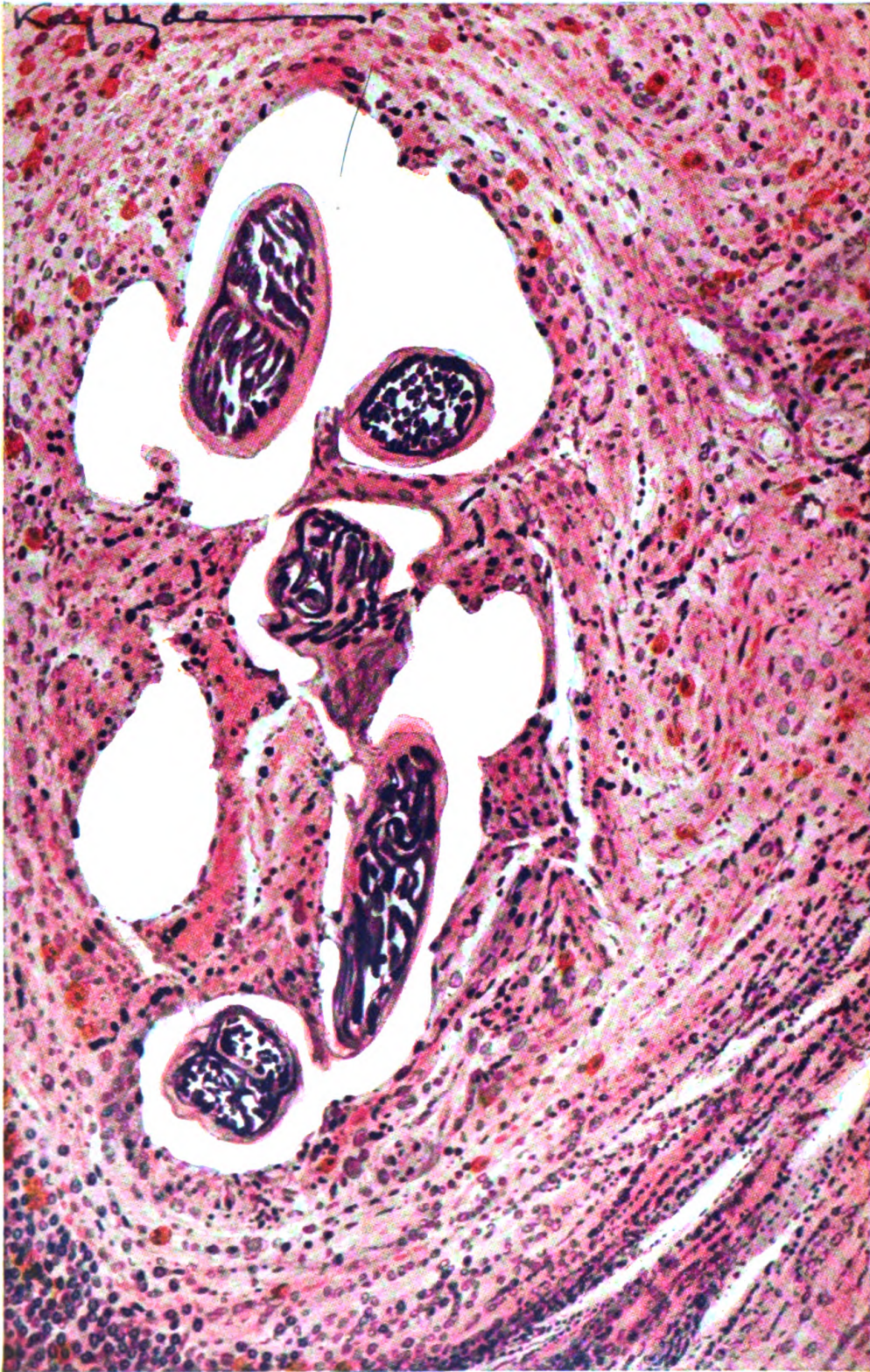
As the worm increases in maturity these findings become more pronounced and the node increases perceptibly in size. At this stage there is also an increase in the reticulum in the node, with proliferation of endothelial cells and plasma cells.

When a gravid female *Wuchereria bancrofti* approaches maturity, characteristic anatomic landmarks can be identified which distinguish it from other forms. The cuticle is homogeneous, clear, without striae, and stains pink with hematoxylin and eosin. The ovarian tissues, however, retain the hematoxylin stain. In the female, the uterus is double, and the microfilariae stain with hematoxylin. A growing, living worm causes few apparent degenerative changes in its immediate environment. In a lymph node, hyperplasia and edema, with eosinophilic cell infiltration, are the main responses.

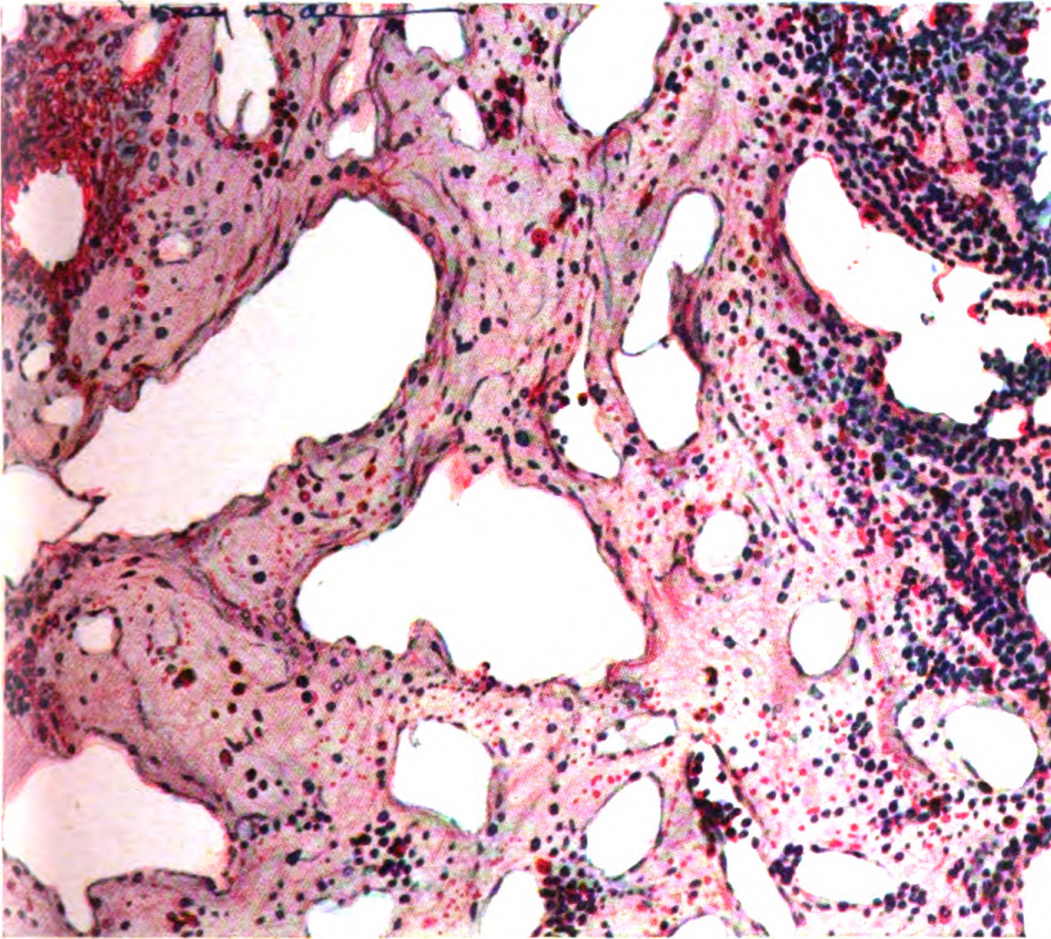
When degenerative changes occur in the worm, due to circulatory alteration or action of the reticulo-endothelial barrier, the surrounding tissues react rather characteristically. It is in these lesions that familiarity with the histologic picture is necessary in



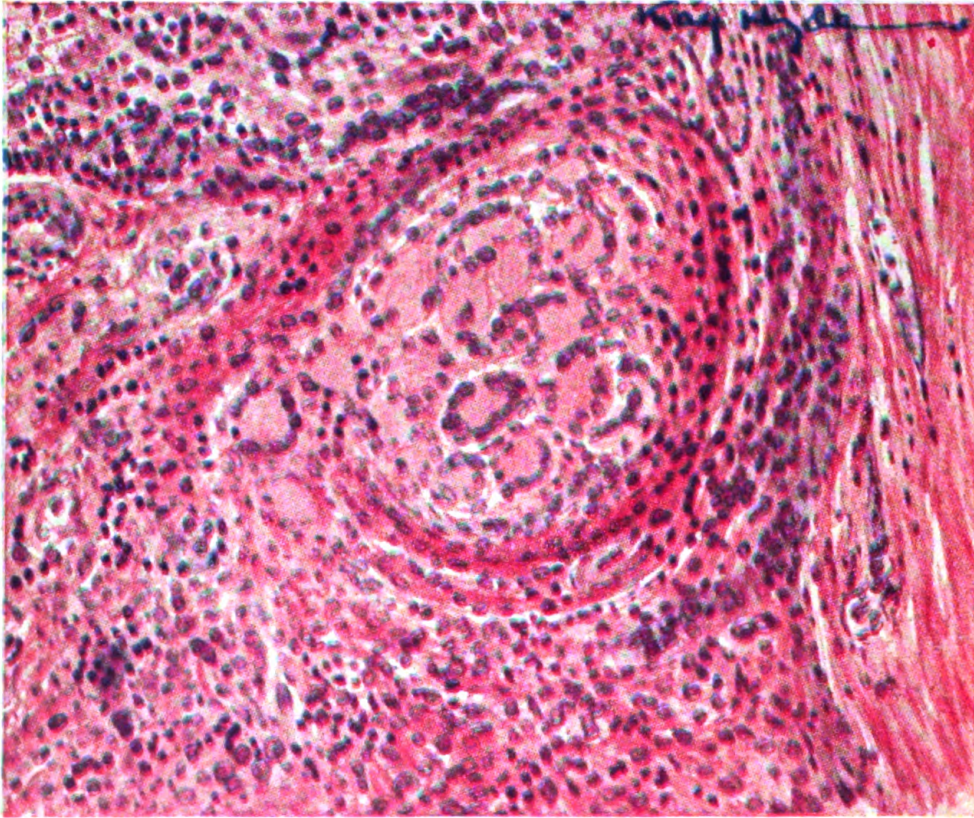
1. Camera lucida illustration of lymph node showing large fluid accumulations interspersed throughout the node. These nodes become swollen, edematous, but generally retain their normal configuration of primary and secondary follicles. Vascular engorgement is accompanied by eosinophilic cellular infiltration. This picture is in all probability an allergic response to worm foci elsewhere in the body, as serial sections fail to reveal filariae in all instances. It is also conceivable that this picture develops in a node or lymphatic channel upon lodgment of infective microfilariae with subsequent growth.



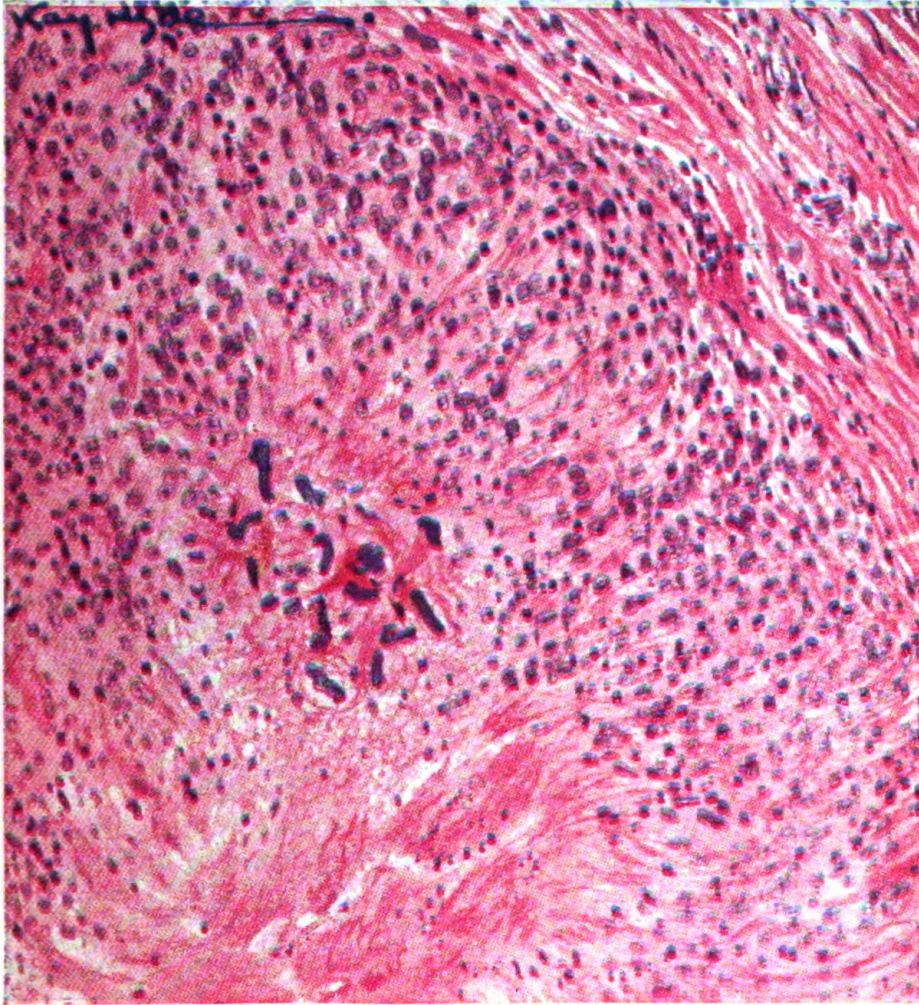
2. Microscopic section of an adult gravid female lodged in a lymph node. Note the uterine sections containing embryonic microfilariae. The characteristic double uterus of *Wuchereria bancrofti* is well illustrated. The surrounding tissues are edematous and contain large numbers of eosinophilic cells.



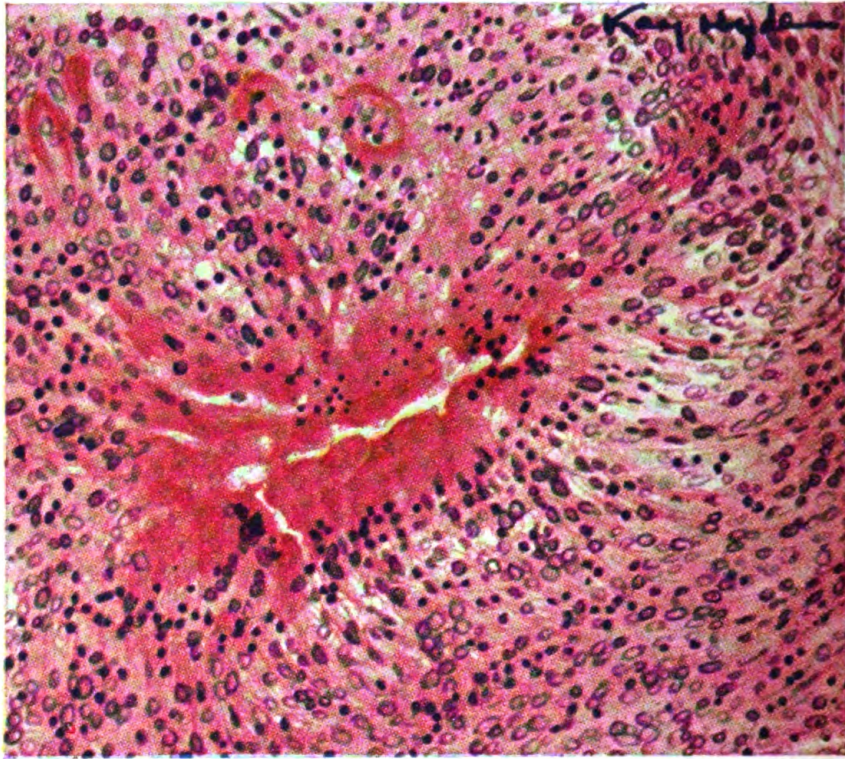
3. A constant finding in all lymphatic channels or nodes is the development of marked varicosities as shown above. The surrounding stroma is edematous, congested and heavily infiltrated by eosinophilic cells.



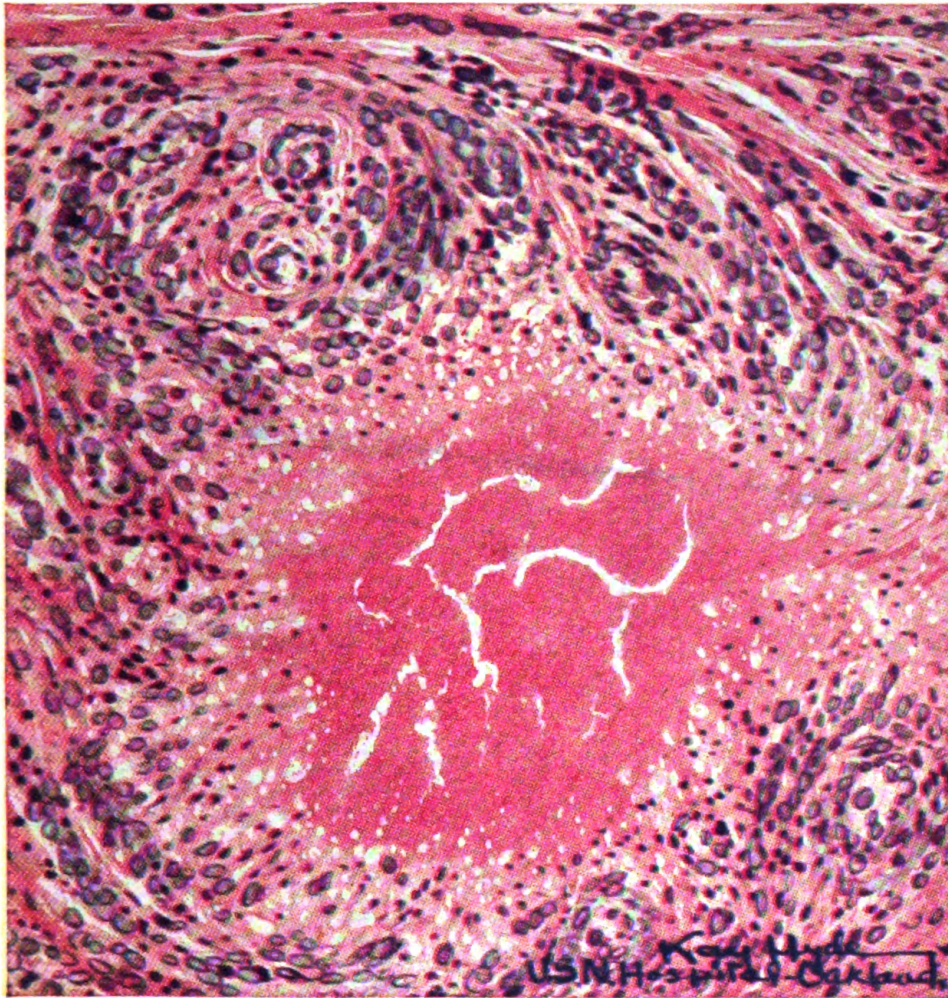
4. Giant cells are constantly present in all tissues containing filariae. They may appear early when the worm is still present and in a state of beginning degeneration, but more commonly are seen after the worm has been absorbed. This particular stage may be easily confused with Hodgkin's disease, tuberculosis, or other chronic granulomas.



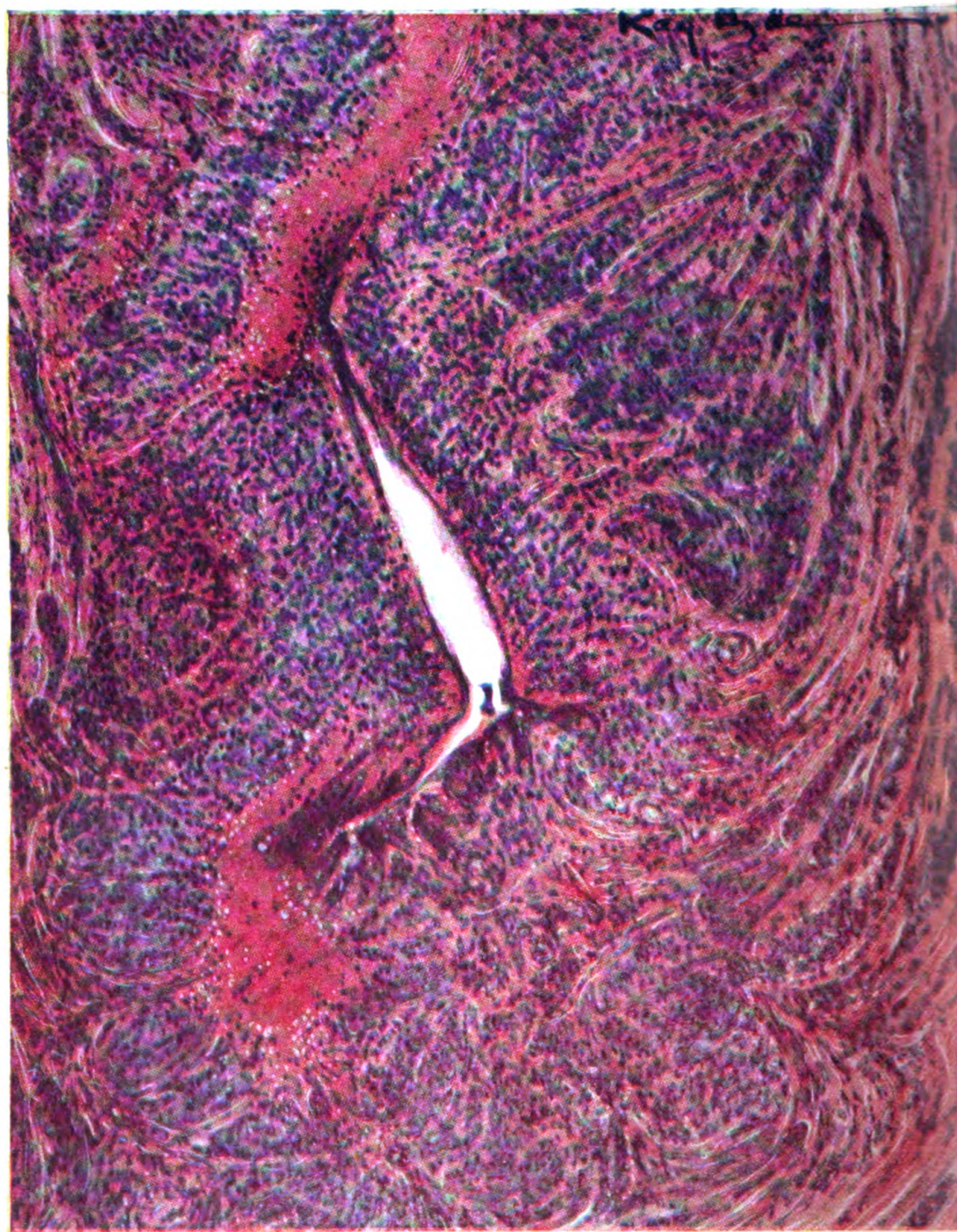
5. Later stage in the process, showing absorption of the worm, with a few degenerated, partially calcified microfilariae retained in the scar tissue.



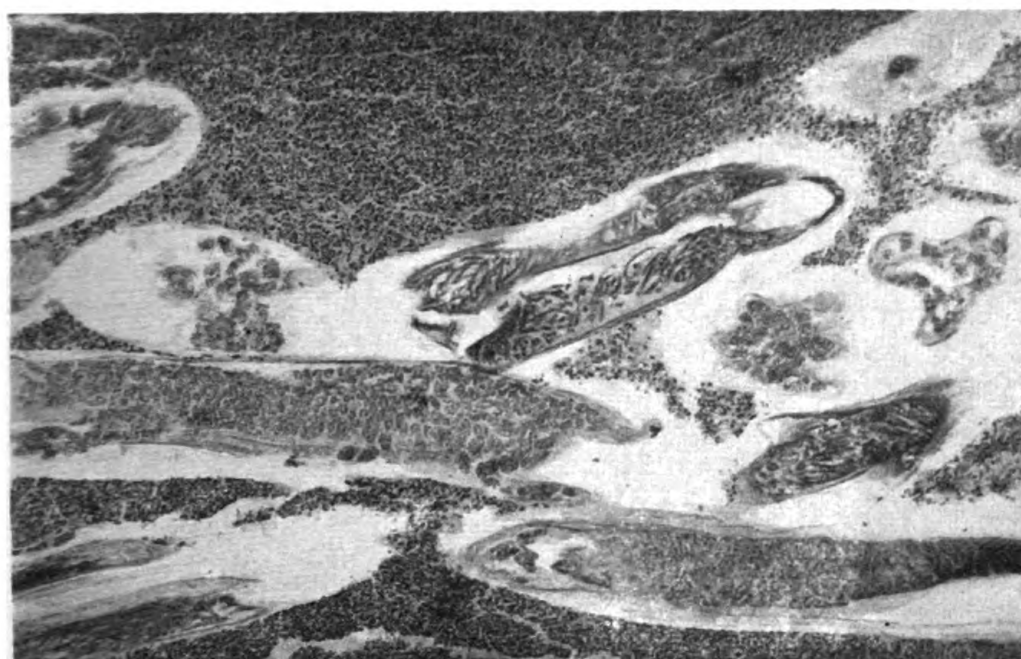
6. Beginning of the homogeneous scar left by the absorbed filarial form. This stage also may easily be confused with other granulomas.



- 7.** The end stage of a homogeneous scar left by the degenerated worm. This is the most advanced stage observed to the present in this series of biopsies.



8. Characteristic picture observed in a lymphatic channel. Note the almost complete obliteration of the lumen with marked proliferation of the chronic granulation tissue. The characteristic undulating configuration is presumed to be due to the coiled position of the worm in situ.



9. Section of lymph node containing a living, gravid female *Wuchereria bancrofti*. Note the double uterus containing embryonic microfilariae, the characteristic ova in other portions of the worm, and the very heavy eosinophilic cellular reaction surrounding the worm.

order to detect the influence of filarial parasitism. Before the present war, few pathologists in this country had much experience with filarial problems, and many of the characteristic tissue changes were comparatively unknown. Experience has been gained in biopsies which will, however, yield criteria for the establishment of this diagnosis even when worm segments cannot be definitely demonstrated. These changes are due to degenerative processes taking place in the worm, with production of granulation tissue, which follows a characteristic pattern. Many of these changes are common to both lymphatic channels and lymph nodes.

Masses of eosinophilic cells, both mononuclear and polynuclear are seen surrounding the parasite. Zones of proliferative fibroblasts encircle the worm segments, merging imperceptibly with and partially replacing lymph follicles. Lymph varices occur within the lymph node, apparently due to proliferation and partial obstruction of the afferent lymph channels.

As these changes are occurring in the tissues of the host, there is also a progressive process observed in the parasite, manifested by the cytoplasm of the ovary or testis cells in the host showing cloudy swelling, and the nuclei showing pyknosis. This progresses on to degeneration and necrosis with a gradual calcification of the parenchymatous elements. The cuticle also becomes involved, with saponification occurring and eventual calcification, leading to de-

struction and even absorption and disappearance of all parasitic fragments. This is effected by the reticulo-endothelial system by production of hyalinized scar tissue with foreign-body giant cells simulating chronic tuberculosis or other granulomas in histologic structure.

Because of the production of this unique granulation tissue, investigation was undertaken on the theory that incorrect conclusions may be drawn on biopsy studies. For with the disappearance of the worm, or the inability to demonstrate the worm because of insufficient sections, a diagnosis may be missed.

The sequence is similar to that occurring in other infectious granulomas with the added effect of a foreign-body irritation. Cellular reactions and edema give way to vascular hyperplasia, fibroblastic proliferation, increased amounts of reticulum in lymph nodes, caseation and eventual absorption of the parasite, and its replacement by a proliferative granulation tissue. This leads eventually to a decrease or disappearance of reticulum, and formation of hyalinized or even calcified scar tissue.

Because of the apparent sequence of histologic changes and the importance of these changes in histologic diagnosis, a knowledge of the various stages is essential in making a presumptive or positive diagnosis of filariasis.

With this thought in mind, carefully chosen slides were submitted to the Committee on Pathology, Division of Medical Sciences, National Research Council. These were slides removed from filariasis nodes or lymphatics and chosen because they showed characteristic tissue reactions without demonstrating the typical parasites. Typical worms had previously been demonstrated in other slides in all instances, thus establishing the entity beyond any question of doubt. These slides of "unknowns" were subsequently reported as follows:

Knowing that these sections are from nodes said to contain filariae, the interpretation cannot be entirely unprejudiced. Nevertheless it can be said that the presence of the sort of acute hyperplasia described, with many eosinophils widely scattered in node, capsule and pericapsular tissues, and with fibrosis, suggests filariasis of the node.

When, in addition, there are granulomatous foci having the features of a foreign-body reaction, but differing morphologically from tuberculosis, syphilis, tularemia and lymphogranuloma inguinale, the lesion has strong presumptive diagnostic importance.

Biopsy of lymph nodes may furnish evidence of filariasis in geographic regions where the disease occurs and the patient presents suggestive clinical phenomena. It may be used to supplement the investigation of cases but should not replace examination of the blood for microfilariae.

It is contended that one can go somewhat further than this guarded statement, for it has been apparent that the lesion ob-

served in most of these nodes is sufficiently characteristic so that filariasis should be suspected. It may be tentatively diagnosed regardless of the lack of a history of exposure, or of the patient's being in an endemic region, even when the parasite cannot be identified. It has been my experience also that examination of the blood of these particular patients for microfilariae is entirely inadequate for diagnostic purposes.

CONCLUSIONS

It would follow, then, that the most important single diagnostic procedure, apart from the clinical history and physical examination, is the examination of lymph node or lymphatic tissues for evidence of filariasis. All other laboratory procedures so far are inadequate, although skin testing with *Dirofilaria immitis* antigen is an aid. For correct interpretation of these tissues, one must have knowledge of the changing histologic picture, dependent upon the stage of development of the parasite within the host.

The problem, as judged from careful histologic studies on the lesions, is one of a foreign-body engulfment and absorption of the parasite, resulting in the final production of scar tissue. Host resistance, augmented by action of the reticulo-endothelial barrier, would seem to establish this lesion as being self-limited in nature and ordinarily not productive of such sequelae as elephantiasis, lymph stasis, and secondary infection.

Not only will this infection not result in permanent damage to the vast majority of these patients, but it will probably not become a public health problem in the future in the continental United States. The low percentage of microfilariae found in the peripheral blood, the absence of many of the optimum requirements for spread, such as humidity and heavy rainfall, together with the low incidence of mosquitoes capable of serving as intermediate hosts, will serve to halt any possible spread to the civilian population in the United States. These points are all enhanced because of better public health control and the generally better, more hygienic living conditions which prevail in this country.

SUMMARY

Filariasis in its incipient stage of lymphangitis and lymphadenitis has become a problem of both military and medical importance. The presence of the parasite in the definitive host (man) initiates a foreign-body granulomatous reaction which is characteristic of the disease. The immune reactions of the host, together with the reticulo-endothelial barrier in his lymphatic system, are presumed to be sufficient to destroy and engulf the parasite in most instances, provided the patients (hosts) are evacuated from endemic areas.

Examination of the blood for microfilariae is inadequate for diagnostic purposes. The laboratory method of choice is biopsy of the suspected lesions. A detailed study of these tissues has afforded much valuable information, not only in diagnosis but in progress and prognosis as well.

From conclusions based on laboratory examination, it may be stated that this disease will not be a public health problem in the continental United States and that permanent physical damage to the individual will probably be negligible. Many of the lesions seen in filariasis are presumed to be allergic in nature.

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PENICILLIN RECTALLY

The rectal administration of penicillin has not been attempted probably because of the assumption that the presence of the penicillinase-producing colon group of organisms might serve as an impenetrable barrier. Despite misgivings in this direction, experiments were undertaken to explore the possibilities of rectal administration. Various amounts of the sodium salt of penicillin were incorporated by hand in a simple cocoa-butter base. Suppositories were inserted rectally without any previous preparation in hospitalized in-bed patients, selected at random, and in healthy ambulatory volunteers.

Appreciable penicillin blood titers were obtained in 12 out of 14 instances. Effective levels were found after 24 hours in 2 instances and for 4 to 12 hours in an additional 7 subjects.—LOEWE, L.; ALTURE-WERBER, E.; and ROSENBLATT, P.: Administration of penicillin by rectal suppository. J. A. M. A. 128: 18, May 5, 1945.

EVALUATION OF MEASURES FOR USE AGAINST COMMON FUNGUS INFECTIONS OF SKIN

**SCREENING TESTS BY MEANS OF PAIRED COMPARISONS
ON HUMAN SUBJECTS**

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In the tropics, fungus infections of the skin are one of the greatest causes of disability (1) (2) (3) (4) (5) (6). Moreover, medicaments and measures effective in temperate climes and in civilian practice often prove ineffective and indeed prohibitively irritating under the demands of military activities and under tropical conditions.

There are, however, almost as many different approaches and different opinions as to the best methods of prophylaxis and of therapy as there are investigators and dermatologists. Anyone examining the recommendations from authoritative sources cannot avoid being somewhat disturbed by their number and diversity. Among the reasons for these divergent opinions are that:

1. Laboratory studies of fungistatic or fungicidal activity of medicaments used give a very inaccurate picture of the relative values of different agents. Clinical effectiveness and in vitro activity are not necessarily parallel. Moreover in vitro studies give no hint as to the substance's irritant or sensitizing properties as affecting human skin.

2. Clinical studies in prophylaxis are rendered difficult by the fact that the incidence of active cases is quite unpredictable. No one can foretell with certainty what the incidence of active fungous diseases in a random population is likely to be, and therefore no one can evaluate exactly the benefits which may have been derived from a given prophylactic procedure.

3. Clinical studies in therapy are rendered difficult by the fact that the course of fungous diseases is erratic; cases of apparently equivalent extent and degree often respond in radically dissimilar fashion to identical therapeutic measures. Thus in some instances the condition will remain active and incapacitate the patient for

weeks or months, while the large majority of clinically similar cases clear up rapidly, either spontaneously or under the simplest measures, such as calamine lotion, wet compresses, or boric ointment.

4. The microscopic or cultural demonstration of the presence or absence of fungi, or of their comparative rate of disappearance from affected areas, is not a reliable criterion of relative effectiveness of different remedies. It will often be impossible to demonstrate fungi after application of almost any form of topical therapy, and the lesions may nevertheless continue to be clinically active and progressive. Conversely fungi may often be present in clinically normal skin areas long after the active stages have abated. Moreover pathogenic fungi can often be found as supervening, chance invaders in skin lesions due to other causes; and conversely the clinically important secondary lesions of fungous diseases are regularly free from demonstrable fungi.

One way in which to attempt to evaluate different prophylactic or therapeutic measures is to try them out in very large series of cases. In order to yield results of statistical significance, studies of this kind necessitate such large series and are long and tedious. They are, moreover, almost always subject to the errors produced by uncontrollable variables, such as the different intensities of exposures to infection and to reinfection; different degrees of care and regularity in the employment of the measures; and different types of occupations and activities on the part of the different groups.

Because of such difficulties, many of the recommendations for new and ostensibly better measures for treating or preventing fungous infections are based on insufficiently controlled evidence or on differences which are not significant from the statistical viewpoint. The need for more rapid, simple, and accurate methods for evaluating the relative merits of different topical remedies has therefore long been apparent.

Recognizing these facts, it was decided to attempt to develop a method which would take full advantage of the circumstance that most cases of acute fungous infection of the feet are symmetrical in distribution. That is, these infections generally tend to affect both feet at approximately the same time and to approximately the same degree, and both feet tend to respond equally to therapy. It was thought that simultaneous paired comparisons of two different prophylactic or therapeutic measures, each on one foot of the same individual, would constitute a rapid clinical screening method for ascertaining the relative value of any two agents.

In order to carry out such a study, it was recognized that a sufficiently large group of subjects must be available, that the natural incidence of active fungous infection must be sufficiently high in these subjects, that the subjects must remain under close medical observation for sufficient periods of time, and that they must be rigidly controlled so as to exclude any possible switching or transfer of a remedy used on one foot to the other foot.

The Naval Disciplinary Barracks at Hart's Island, New York, was selected for such tests and a small research team was organized to carry out studies on various antifungous measures. The results of this investigation have been reported in detail by Shaw (7). The object of the present article is to summarize briefly the methods employed and some of the results which may prove of practical interest.

The prisoner census at this activity was over 2,000 men, the large majority of the prisoners serving sentences of more than 4 months. It was estimated that over 2 months' observation of each subject might be required.

Moreover the prisoner-subjects could be kept under more exact and uninterrupted observation than could other types of Naval personnel. The medical observations would not be hampered by duties, leaves, liberties or transfers, and in turn the medical studies would not interfere with important training, duties, or privileges of Naval personnel. It was also apparent from the outset that certain details of the contemplated studies, such as using different remedies and wearing different footgear on each foot, could not well be carried out except on subjects remaining uninterruptedly within an institution.

An important additional advantage was believed to lie in the fact that prisoners who volunteered for the study could be expected to receive benefit in the way of improvement of morale and accelerated progress toward rehabilitation.

Since the principal objective of the investigation was to evaluate various agents in the prophylaxis and treatment of fungous infection under the normal working conditions of the service, during the period of the study the prisoner-subjects continued with their routine duties of marching, drill, exercise, and work in the fields and on the coal pile.

AGENTS STUDIED

The first agents chosen for comparative evaluation were:

1. The fatty acids and salts which Peck and Rosenfeld and their coworkers (8) (9) had originally described as being among the most effective against the particular fungi concerned (propionic acid and undecylenic acid).

2. As "positive control," a representative of the ordinary boric acid-salicylic acid combinations present in many widely used and "issue" foot powders.

3. Socks and shorts impregnated by the water-in-oil emulsion process with Impregnite CC3, which according to chance observations on the part of other investigators had appeared to benefit some cases of fungous infections of the skin.

In one series of comparative tests the same agent (undecylenic acid-zinc undecylenate mixture) was incorporated in both a powder and an ointment vehicle in order to evaluate the effects of the vehicles themselves.

Emphasis was placed on the powder forms of preparations because of their properties of being easy and safe to carry and store, their stability and their convenience of use and application. It is obvious that for constant and repeated use, for rapid and "non-messy" application, a "dusting powder" is distinctly superior to liquids or ointments. During the present study our observations and questions have confirmed the opinion that powders will be used far more generally than would any form of greasy preparation. Moreover a powder has the advantage of absorbing moisture from the skin surfaces of the areas in which the fungi usually thrive. All of these characteristics of powders are particularly desirable in a preparation for prophylactic use under tropical conditions.

The particular fatty acids, or their salts, or the combination were selected for study not only because they had been demonstrated to have fungicidal properties and because they already had some clinical background in treatment, but principally because, of all the agents recommended for the treatment of superficial fungous infections, the action of these fatty acids and salts appeared to be the most physiologic and the least likely to irritate.

DESCRIPTION AND FORMULAS OF THE FIVE MATERIALS STUDIED

FORMULA No. 8.

17. *Propionate powder (pigmented)*¹

	Percent
Sodium propionate (duPont "Mycoban")	20.0
Talc, U.S.P.	79.5
Polychloro copper phthalocyanine (green)	0.5

18. *Undecylenic acid-undecylenate powder (pigmented)*¹

	Percent
Zinc undecylenate ²	20.0
Talc, U.S.P.	76.0
Undecylenic acid, Grade AA	2.0
Dibenzo thio indigo (red)	2.0

19. *Boric acid-salicylic acid powder (pigmented)*

	Percent
Salicylic acid, U.S.P., powder.....	2.0
Boric acid, U.S.P., impalpable powder.....	6.0
Zinc stearate, U.S.P.....	3.0
Talc, U.S.P.	86.5
Dibenzo thio indigo (red).....	2.0
Polychloro phthalocyanine (green).....	0.5

21. *Undecylenic acid-undecylenate ointment (pigmented)*

	Percent
Undecylenic acid, Grade AA.....	5.0
Triethanolamine	3.0
Zinc undecylenate ¹	18.0
Propylene glycol, N.F.	10.0
Carbowax, 1,500	19.0
Carbowax, 4,000	29.6
Water, distilled	15.0
Dibenzo thio indigo (red).....	0.4

The fifth study was made on socks and shorts impregnated with Impreg-nite CC3 by the oil-in-water emulsion process.

Each preparation and its container was given a distinctive color (red, green, and brown). The pigments used were selected because of their established lack of locally irritant or systemically toxic properties. Before use each of the coloring materials was tested for fungicidal and fungistatic action in vitro. Neither of the pigments produced the slightest inhibition of growth of *Epidermophyton interdigitale* or of *Aspergillus niger*. In order to rule out any remote possibility that differences in effects achieved could be due to the different pigments, both of the coloring materials used in the fatty acid preparations were incorporated in equivalent concentrations in the boric acid-salicylic acid powder which was used as a control (Formula No. 8, 19).

Further information on the general lack of irritant and sensitizing properties of the agents was obtained by means of patch tests. These tests were performed with the colored undecylenic acid-undecylenate mixture, the colored sodium propionate formula, and the colored salicylic acid-boric acid control on 270 volunteers.

¹ Any results obtained with these powders cannot be taken as indicative of the relative effectiveness of mixtures of undecylenic acid and any of its salts as contrasted with mixtures of propionic acid and any of its salts. At ordinary temperatures propionic acid is a liquid and will not remain incorporated in powders because of its relatively high vapor tension. It was therefore impossible to compare a powder containing a buffered mixture of propionic acid and one of its salts with the powder containing undecylenic acid and its salt. However direct comparisons of the two acids and their salts in identical ointment vehicles are scheduled for an early date. Recently the question has arisen as to whether the calcium salt of propionic acid may not be superior to the sodium propionate. This question also will be investigated in the near future.

² Wallace & Tiernan Products, Inc.

before the materials were employed prophylactically or therapeutically. The same tests were performed on 182 volunteers at the completion of prophylactic or therapeutic use of the materials. In no instance was there a positive reaction to a skin test or any clinical indication of irritation or of pre-existing or acquired hypersensitivity.

PROCEDURE

The investigation was begun in September 1944 during warm weather when the incidence of new, active cases of fungous infections was relatively high. The observations were continued until the end of the year when the onset of colder weather materially reduced the incidence of new cases.

Detailed mimeographed instructions were issued to each subject as to the method of treatment or prophylaxis, according to the schedule planned for his group. The Marine guards in charge of the dormitories were informed as to the prophylactic or therapeutic procedure each man had been instructed to follow. In addition to this supervision and to the weekly medical examinations, unannounced dormitory visits were made by the medical officer and hospital corpsmen.

Volunteers from the prisoner personnel who had 3 or more months of an unfinished sentence to serve were recruited as subjects for the prophylactic experiment. They were examined for evidence of fungous infection of the feet and groin. Those showing any evidence of active fungous infection on first examination were excluded from the prophylactic study, but were included in the therapeutic series.

PROPHYLACTIC STUDIES

The subjects in the prophylactic series were divided into five groups according to the following schedules of prophylaxis:

Group A.—Foot prophylaxis, using (1) undecylenic acid-undecylenate powder on the right foot, and (2) boric and salicylic acid powder on the left foot.

Group B.—Foot prophylaxis, using (1) boric and salicylic acid powder on the right foot, and (2) propionate powder on the left foot.

Group C.—Foot prophylaxis, using (1) undecylenic acid-undecylenate powder on the right foot, and (2) propionate powder on the left foot.

Group D.—Foot prophylaxis, using (1) an impregnated sock on the right foot, and (2) no treatment on the left foot (control).

Group E.—Foot control: No treatment on either foot.

These five groups comprised 567 men who had been examined and found free of active infection. After institution of the respective prophylactic measure, each subject was examined each week for evidence of active infections of the feet and groin. All suspected lesions were examined microscopically. In the absence of microscopic evidence, definite clinical lesions were considered a positive indication of active infection. Each man used two different prophylactic measures, one on each foot, and all men were instructed to use the preparations in an identical manner.

TABLE 1.—*Results of prophylactic studies*

Series	No. of men	Prophylactic employed	Foot	No. of feet developing active infection during use of the prophylactic
A	137	Undecylenic acid-undecylenate powder.....	R	1
B	114	Boric acid-salicylic acid powder.....	L	15
		Boric acid-salicylic acid powder.....	R	13
C	144	Propionate powder.....	L	4
		Undecylenic acid-undecylenate powder.....	R	2
D	84	Propionate powder.....	L	4
		No measures—plain issue sock.....	R	7
E	88	Impregnated sock.....	L	7
		No measures—control series.....	R	8
		do.....	L	8
Totals.....		Undecylenic acid-undecylenate powder.....		1.07 percent
		Propionate powder.....		3.10 percent
		Boric acid-salicylic acid powder.....		11.15 percent
		Impregnated sock.....		8.33 percent
		No prophylactic measures (controls).....		8.85 percent

When no prophylactic measures were employed during the period of investigation, the incidence of active fungous infections of the feet was 8.85 percent (260 observations).

Neither the wearing of CC3-impregnated socks nor the use of the usual type of issue powder (boric acid-salicylic acid) reduced the incidence of active infection (8.33 percent and 11.15 percent respectively). However there was a sharp decline in the incidence of active foot infections under the use of either the propionate powder or the undecylenic acid-undecylenate powder, the latter being somewhat more effective (incidence of 3.10 percent and 1.07 percent respectively).

The number of observations in some of these prophylactic series may be insufficient to consider the results statistically significant. But as will be seen these suggestive trends in relative prophylactic effects are supported by the identical direction of results with the different agents in the therapeutic series.

THERAPEUTIC STUDIES

Therapeutic studies were carried out on all available subjects found to have active fungous infection of the feet or groins. Some

of these infections were discovered while selecting subjects for the prophylactic studies; some of the men were referred by the sick-bay and a few came directly to the laboratory for treatment.

The foot cases were divided into three groups for comparative evaluation of the following three pairs of treatment measures:

1. Undecylenic acid-undecylenate powder (right foot) vs. propionate powder (left foot).
2. Undecylenic acid-undecylenate powder (right foot) vs. undecylenic acid-undecylenate ointment (left foot).
3. Impregnated sock (right foot) vs. nonimpregnated sock (left foot).

The groin cases were divided into three groups for study of the following three different types of treatment:

1. Undecylenic acid-undecylenate powder.
2. Propionate powder.
3. Impregnated shorts.

TABLE 2.—*Summary of therapeutic results (foot and groin)*

Foot	No. of feet	Percentage cured	Time required (weeks)	Percentage improved	Time required (weeks)	No change	Time (weeks)	Percentage worse
Undecylenic acid-undecylenate powder	* 103	79	4.6	20	3	1	7	0
vs. Propionate powder	98	67	4.6	26	3.9	6	6.2	1.1
Undecylenic acid-undecylenate powder	50	74	4.3	26	3.8	0		0
vs. Undecylenate acid-undecylenate ointment	* 46	74	4.3	24	3.5	2	4	0
Impregnated sock	16	25	4.3	12	3.5	50	4.4	13
vs. Nonimpregnated sock	16	12	5.5	19	3.3	56	5	13
Groin								
Undecylenic acid-undecylenate powder	44	80	3.5	18	2.7	1	4	0
Propionate powder	17	59	5.5	18	4	23	4	0
Impregnated shorts	11	0		0		63	5	37

*The disparity between the two numbers is due to the fact that a few men were included who had active infection of only one foot.

As will be seen in table 2, in the first series in which undecylenic acid-undecylenate powder and propionate powder were compared, 79 percent of the feet were cured while using the undecylenic acid-undecylenate powder, as compared with 67 percent of the feet cured while using propionate powder. It would appear that both measures are effective, with the undecylenic acid-undecylenate powder being perhaps a trifle better (compare with results in prophylaxis).

In the second series, undecylenic acid–undecylenate in the powder vehicle was compared with the same ingredients incorporated in an ointment vehicle. There was no demonstrable superiority of the ointment over the powder. It may therefore be concluded that in the cases seen here (mostly ambulatory patients with from mild to moderate degrees of activity) the powder is as effective as the ointment. This result suggests the possibility of the issuance of a single preparation for general use for both prophylaxis and treatment. However since our studies were carried out mainly on patients with moderate infections, the findings may not apply to severe and incapacitating conditions.

In the third series, in 16 instances one foot was treated by the wearing of the impregnated sock while on the other foot a regulation nonimpregnated sock was worn. There was no significant therapeutic effect to be credited to the impregnated sock (compare the results in prophylaxis).

The results with treatment of the groin indicate that undecylenic acid–undecylenate powder was distinctly beneficial (80 percent cured and 18 percent improved in an average of about 3 weeks). Propionate powder appeared to be somewhat less effective, with 59 percent cured and 18 percent improved in 5.5 weeks and 4 weeks respectively.

Impregnated shorts, on the other hand, were not only completely ineffective, but decidedly harmful, producing irritations in about one-third of the wearers.

THERAPEUTIC STUDIES IN 29 CASES OF MISCELLANEOUS DERMATOSES, INCLUDING 6 CASES OF PITYRIASIS VERSICOLOR

In addition to the prophylactic and therapeutic studies on the common fungous infections of the skin due to epidermophyton or trichophyton fungi, 29 cases of other dermatoses were treated with the fatty acid remedies (undecylenic acid–zinc undecylenate ointment and propionic acid–sodium propionate ointment). There were 9 cases of impetigo, 4 of sycosis vulgaris, 5 of folliculitis, 5 of contact-type dermatitis and 6 of pityriasis versicolor in this group. In none of these cases were the fatty acid remedies superior to the older standard measures. In fact in most instances response was absent or slower than with the usual forms of treatment.

It is particularly noteworthy that the 6 cases of pityriasis versicolor (a superficial fungous infection of the skin by *Microsporon furfur* and a condition usually easily managed by the mildest remedies) showed no response to the acids and their salts. In this connection it is to be recalled that, in diametric contrast

to the epidermophyton and trichophyton infections of the feet and groins, which localize in the more alkaline skin folds and intertriginous areas in which the evaporation of sweat is inhibited, the *Microsporon furfur* infections affect primarily the more acid areas in which sweat is free to evaporate.

SUMMARY AND CONCLUSIONS

The object of the present study was to perform clinical screening tests for the comparative evaluation of different agents in the prophylaxis and treatment of fungous infections of the feet and groin. Prisoner volunteers at the U. S. Naval Disciplinary Barracks, Hart's Island, New York, were selected as subjects. The study was begun in the first week of September 1944 and terminated in December 1944. During this period sufficient clinical material for this type of study was available.

Prisoner volunteers were selected as the subjects for the investigation because they could be kept under the closest possible observation and there would be no interference with the routine of Naval personnel. Moreover the use of prisoner volunteers permitted the elimination of many of the usually uncontrollable important variable factors. A total of 808 prisoner volunteers was used in making screening tests to evaluate the relative effectiveness of five preparations for the prophylaxis and treatment of fungous infections of the feet and groin.

The materials investigated were (a) undecylenic acid-zinc undecylenate powder, (b) sodium propionate powder, (c) boric acid-salicylic acid powder, (d) undecylenic acid-zinc undecylenate ointment, and (e) clothing impregnated with Impregnite CC3. The clothing and medications were colored with inert nonfungicidal dyes to make them easily identifiable.

In order to ascertain whether the agents used were either primarily irritating or sensitizing, patch tests were performed on 270 volunteers before the use of the materials, and were repeated on 182 of these on their completion of about 4 weeks' use of the agents. No positive reactions were elicited by these tests. There was no case of clinical irritation or sensitization.

In studying the different agents used on the feet, a different prophylactic or treatment measure was used on each foot of the subject, thus permitting a direct comparison of the effect of the two measures in the same individual. This procedure was designed to reduce the variable factors of differences in individual susceptibility to infection, differences in intensity of exposure, in reaction to infection and in tendency to spontaneous recovery.

Results in prophylaxis.—Active fungous infections developed

in the respective foot of:

23 of 260 (8.85 percent) men using no prophylactic measures on the feet.

7 of 84 (8.33 percent) men who wore an impregnated sock on one foot.

28 of 251 (11.15 percent) men using boric acid-salicylic acid powder on one foot.

8 of 258 (3.10 percent) men using propionate powder on one foot.

3 of 281 (1.07 percent) men using undecylenic acid-undecylenate powder on one foot.

Though some of these groups are too small to justify final conclusions, the results suggest that the wearing of impregnated socks does not offer protection against fungous infections of the feet. Likewise, the use of the simple, widely-used, general-issue type boric acid-salicylic acid powder does not appear to afford significant protection against fungous infections of the feet. On the other hand, both the propionate powder and the undecylenic acid-undecylenate powder appear to afford some degree of protection, that of the latter powder being perhaps somewhat the superior.

While the results of these prophylactic tests may not all be statistically significant when considered alone, they are supported by the results of the therapeutic studies, which all indicate corresponding trends for each of the agents studied.

Results in therapy.—In the treatment of a total of 160 men with active and usually bilateral fungous infections of the feet, the comparative evaluation of one of the remedies on each foot gave the following results:

1. *Impregnated socks* were of no more value than general-issue socks (16 cases).
2. *Propionate powder and undecylenic acid-undecylenate powder* (98 cases) were equally effective in 62 cases. Propionate powder was superior in 5 cases. Undecylenic acid-undecylenate was superior in 31 cases.
3. *Undecylenic acid-undecylenate powder and undecylenic acid-undecylenate ointment* (46 cases) were equally effective in 35 cases. The ointment was superior in 3 cases. The powder was superior in 8 cases.

In the treatment of a total of 72 active fungous infections of the groin, the results were as follows:

1. *Treated with undecylenic acid-undecylenate powder* (44 cases)
35 cured 8 improved 0 worse 1 unchanged

2. *Treated with propionate powder* (17 cases)

10 cured 3 improved 0 worse 4 unchanged

3. *Treated with impregnated shorts* (11 cases)

0 cured 0 improved 4 worse 7 unchanged

The immediate procurement and issue of new antifungous agents cannot as yet be recommended on the basis of the results of this new type of screening test on a relatively small series of subjects. Nevertheless it appears that these results are sufficiently unequivocal and encouraging to warrant field trials of the better preparations. Arrangements have now been made for testing the undecylenic acid-undecylenate powder, the propionate powder, and the boric acid-salicylic acid control powder in adequately large and carefully supervised field trials.

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CLOSTRIDIUM PERFRINGENS IN BATTLE INJURIES

RAPID IDENTIFICATION BY SIMPLE MODIFICATION OF ALTEMEIER'S METHOD

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War wounds with extensive damage and devitalization of tissue, as are found in many battle injuries, have increased the incidence of gas gangrene infection, and attention has been drawn to the need for an early, rapid identification of the *Clostridium perfringens* (*Cl. welchii*), which is the causative agent in 80 per cent of gas bacillus infections. Objective clinical symptoms do not appear soon enough in most instances for effective treatment; therefore the diagnosis of gangrene infection should largely be a laboratory procedure.

The following method, based upon the excellent work of Altemeier (1), has been used successfully aboard the U.S.S. *Bountiful* during the past 12 months for the detection of gas bacilli in the wounds of patients received from the beachhead and field. The method is simple, accurate and rapid; it makes use of a medium that combines the speed of Thompson's modification of the medium of Wilson and Blair (2) with the characteristic findings in litmus milk and cooked meat broth (3) and without the time needed for preparation by the latter method. Animal inoculation and protection studies, requiring from 48 to 72 hours, are of course impractical due to the time element and therefore only of technical interest.

The stormy fermentation of the lactose in litmus milk by *Cl. perfringens* has long been known as a characteristic peculiar to this germ. The use, however, of milk without an indicator, incubated with strict anaerobiosis, has been found to improve and considerably speed up this reaction. The results can be read within 4 to 8 hours, and in no instance of negative culture, to the present, has the patient later developed *Cl. perfringens* infection.

As fresh milk is unavailable at this activity, the original method of Altemeier has been successfully modified by the use of spray-dried skim milk. This dehydrated product is processed in the standard Navy mechanical cow unit (mixing and pasteurizing

tank, emulsifier, cooler) and the resultant "milk" is treated as follows: It is boiled for 5 minutes and after it has been cooled in a refrigerator for 12 hours, it is distributed in 8-cc. culture tubes, and sterilized by heating in a dry-air oven on 3 successive days at 120° C. for 20 minutes. It is then stored in a refrigerator, and is ready for use.

Material swabbed from the wound has, in most instances, been used to inoculate the tubes. Although Altemeier says that "the results of anaerobic culture of material swabbed from fresh contaminated wounds are not as accurate as those of tissue debrided from the wound," it has been found that this difference, presumably in "strength" of the inoculum, is not of great significance.

Anaerobiosis, after the method of Wright (4), is achieved as follows: The milk tube is liberally inoculated, a cotton stopper is flamed, pushed into the test tube so that its upper level is about $\frac{3}{4}$ inch below the rim of the test tube, about $\frac{1}{4}$ inch of the tube is filled with pyrogalllic acid, from 1.5 to 2 cc. of 10-percent sodium hydroxide is added, and the tube is quickly closed with a rubber stopper.

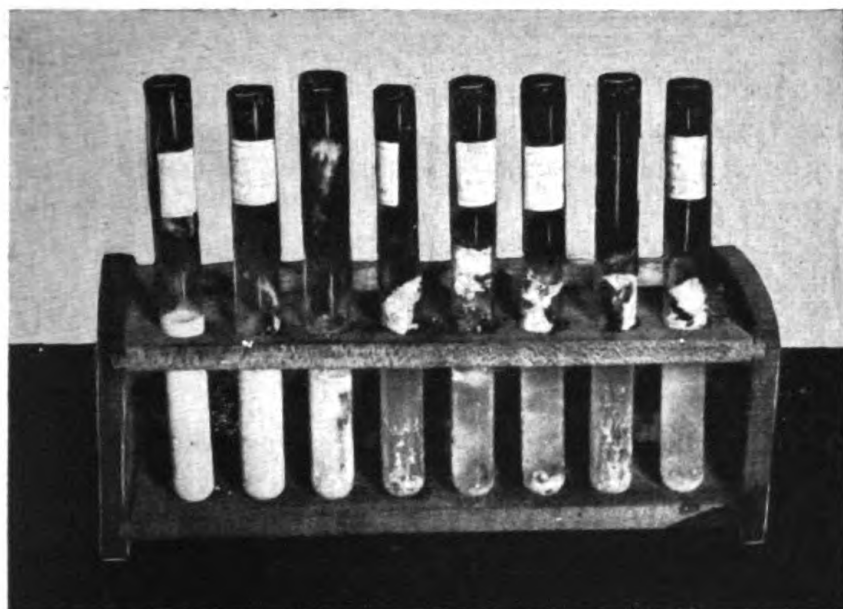
Tubes are incubated at 37° C. and examined at intervals of 2, 4, 6, 8, 10, 12, and 24 hours. No fermentation, or an atypical fermentation at the end of this time, is controlled by smears for predominating organism, and constitutes a negative report.

The reaction of the positive, stormy fermentation is characteristic. Gas bubbles begin to form in as little as 2 hours, this bubbling becomes more active and intense, there is rapid separation of the curd from the whey, and the curd shrinks, becomes solidified, grayish-white, full of spongelike holes, and floats on top of the clear whey. This final phase is usually complete within from 4 to 7 hours, seldom more than eight.

The organism is then examined for morphology, motility, and staining characteristics. In every instance of such a reaction, a large gram-positive, nonmotile rod, characteristic of *Cl. perfringens*, has been found.

We have attempted to evaluate the cultural reactions as follows:

1. Cultures positive in from 4 to 6 hours are considered definite for gas gangrene infection, symptoms presenting.
2. Cultures positive after 8, 10, or 12 hours are reported as *Cl. perfringens* and the surgeons are cautioned to give gas gangrene antitoxin (20,000 units) and to watch for the appearance of symptoms.
3. Positive cultures after from 12 to 18 hours are also reported as such, and patients are carefully observed for symptoms. Usually gas gangrene antitoxin (prophylactic dose) is given.



Cultural reactions in milk media. The first two tubes (left) illustrate a negative fermentation (24 hours). The third tube shows an atypical fermentation, not *Cl. perfringens* (24 hours). The last five tubes in the series are all typical stormy fermentations caused by *Cl. perfringens*. The shrunken curd can be seen above the whey. In the fourth and eighth tubes the corks were blown out by gas production and were loosely replaced (5 hours).

4. Cultures after from 18 to 24 hours' incubation, showing no reaction, are definitely considered negative, and any fermentation at the end of this period is disregarded, as it is usually atypical and due to other bacteria.

A number of other organisms, notably those of the coli-aerogenes group, also ferment and coagulate milk (5) to some degree; none, however, shows the remarkably rapid and eruptive fermentation of *Cl. perfringens*. The latter will frequently be so strong as to blow a tightly inserted stopper completely out of the tube. With other organisms, there may be some settling of the curd, leaving a supernatant whey, but this usually takes almost 24 hours, and is in no way similar to the previously described reaction.

To summarize briefly, Altemeier's cultural technic has been modified by using milk made by a mechanical cow, which makes the method available on ships and stations where fresh milk cannot be obtained. Also a practical working method of evaluating the cultures in relationship to the disease has been evolved. In conclusion, it may be said that, with the cooperation of the surgical and laboratory staffs, it is possible to determine quickly and

accurately the presence of *Cl. perfringens* infection in traumatized wounds.

The indication for therapeutic measures may, therefore, be determined before advanced clinical symptoms occur. Unnecessary loss of limb, and even life, may be prevented by the sure knowledge of the presence or absence of this bacillus. Swab inoculation of milk media under anaerobic conditions gives a typical, stormy fermentation in from 4 to 8 hours when the organism under culture is *Cl. perfringens* (*Cl. welchii*), and has been found of great importance in the diagnosis and management of clostridium gangrene.

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TROPICAL ULCER

The basic facts regarding the cause of tropical ulcer can be epitomized in the alliterative mnemonic: Filth, food, friction, fuso-spirillosis.

The ointments bipp and zipp were found to be very effective therapy, but powdering the ulcer with a thin layer of crystals of potassium permanganate as a preliminary to the dressing produced rapid healing in some otherwise resistant cases.

Of 85 cases, 59 were completely healed in an average time of just over 2 weeks; the majority healed in less than 7 weeks; the most obstinate case took 27 weeks to heal. Twenty-six cases defaulted, but 9 of these are known to have healed. Autophytism was an important element in causing defaulting.—MARSH, F., and WILSON, H. A.: Tropical ulcer. *Tr. Roy. Soc. Trop. Med. & Hyg.* 38: 259-270, March 1945.

RHEUMATIC FEVER OUTBREAK

AT A TECHNICAL TRAINING SCHOOL¹

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In the winter and spring of 1943 to 1944, twenty cases of acute rheumatic fever and six additional cases of questionable rheumatic fever occurred among the students of a Coast Guard Radio School. The total strength of the school during the period of observation was 682 men, with a peak of population at any one time of 570 men.

An epidemiologic study was carried out to ascertain if possible the reason for this very high incidence of rheumatic fever. Added interest was attached to the epidemic disease patterns at this activity inasmuch as certain differences were found in the spread of respiratory infections from those observed in recruit training camps.

Recruit training centers represent, for most men from civilian life, their first experience in such crowded living conditions with the concomitant heavy exposure to respiratory infections and rapid exchange of infectious material. Technical training schools, on the other hand, receive men from recruit camps and other activities, who have already been exposed and may be carriers of infection. Epidemic spread may arise in the schools from such carriers, but the tempo differs from boot camps. So far as respiratory disease is concerned, the school population is no longer virgin soil for the organisms introduced.

The course of training at the radio school lasted 4 months. Graduation and the reception of incoming companies occurred at monthly intervals throughout the winter. In all, five groups of two companies each were observed throughout their 4 month-training period.

The great majority of the men at this school were received

¹The authors are indebted to Assistant Surgeon General Carl Michele U.S.P.H.S., for permission to investigate this outbreak, and to Lieutenant Commander W. W. O'Steen U.S.C.G., Commanding Officer of the Coast Guard Radio School, Silver Springs, Md., for his help and cooperation in furthering this study.

²Killed by a mine near Zen'ca, Yugoslavia, on 13 April 1945.

from a Coast Guard training station in New York, either directly from recruit training or following a 6-week stay at pre-radio school at this same training station. Most of the men were under 25 years of age and from northern urban communities.

The men were housed in a large wooden barracks consisting of four dormitory sleeping quarters. In addition to the dormitories, heads, and showers, the barracks contained a small dispensary and sickbay of six beds under the direction of two hospital corpsmen. The sleeping quarters were equipped with double-decker bunks adequately separated. Ventilation was satisfactory but difficulties were reported with the forced-draft hot-air heating system in the month of January. The barracks were said to have been uncomfortably cold for a period until the heating system was repaired.

The other buildings of the school consisted of a recreation and mess hall and a building for laboratories and classrooms. The work required of the students was exacting, and there was little time for liberty.

TABLE 1.—Incidence by companies of dispensary visits and sickbay or hospital admissions for respiratory illness and rheumatic fever

Company number.....	2		3		4		5		6		Total company strength	
Date of formation.....	27 November		20 December		20 January		20 February		17 March			
Company strength.....	64		116		115		157		163		615	
	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent
Dispensary visits for colds and sore throats*.....	36	56.2	59	50.9	46	40.0	50	31.8	30	18.4	221	35.9
Admissions:												
Influenza.....	5	7.8	26	22.0	13	11.3	14	8.9	17	10.4	75	12.2
Streptococcal infections**.....	2	3.1	4	3.4	3	2.6	4	2.5	4	2.5	17	2.3
Rheumatic fever***.....			5	4.2	3	2.6	9	5.7	2	1.2	19	3.1
Questionable rheumatic fever.....			1	0.8	1	0.9	3	1.9	1	0.6	6	1.0
German measles.....					2	1.7	4	2.5	1	0.6	7	1.1
Total admissions....	7	10.9	36	30.4	22	19.1	34	21.7	25	15.3	124	20.2

*Multiple visits for same person not counted.

**Includes eight cases of scarlet fever.

***One case of rheumatic fever not listed from Company 1 whose total roster was not available.

A summary of attack rates for respiratory infections and rheumatic fever by companies admitted at successive intervals throughout the winter is given in table 1. Companies 2 and 3, admitted at the time of the influenza epidemic of November and December 1943, show the highest respiratory morbidity. A rate of 3.1 percent, or 31 per 1,000 strength, for acute rheumatic fever is considered very high in a population of young adult males.

In figure 1 the incidence of respiratory illness by calendar weeks

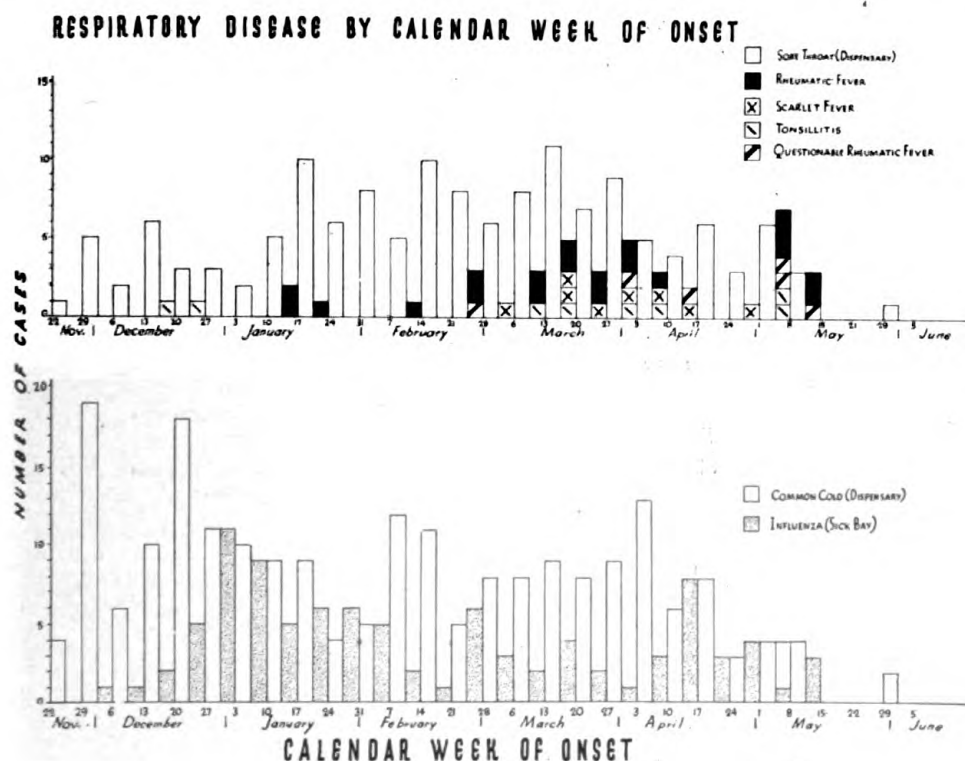


Figure 1.

reveals the very high rates at the time of the influenza epidemic. Later in the winter all illness was more predominantly streptococcal in nature, and in the case of hospital admissions was largely acute rheumatic fever or scarlet fever. The dates of entry of companies 2 and 3 into the school as indicated on the chart were followed each time within a week by high peaks of colds. This would indicate high infectivity of the environment at that time, permitting rapid spread of infection among men relatively susceptible to the infecting virus.

The frequency of dispensary complaints and admissions for respiratory disease by individual diagnoses is shown in figure 2. Here the difference is clearly shown in time relationships between virus or nonspecific respiratory disease, (dispensary "colds" and influenza admissions,) and the streptococcal group (dispensary "sore throats," tonsillitis, scarlet fever and rheumatic fever).

Among the 20 cases called definite acute rheumatic fever there was a typical distribution of signs and symptoms. Fifteen patients were transferred to the U. S. Naval Rheumatic Fever Convalescent Hospital at Corona, California. One patient died and the diagnosis of rheumatic heart disease was confirmed at autopsy. The remaining four were discharged to duty but one of these was admitted later to a U. S. Marine Hospital with a recurrence of the disease. Another had two admissions for rheumatic fever

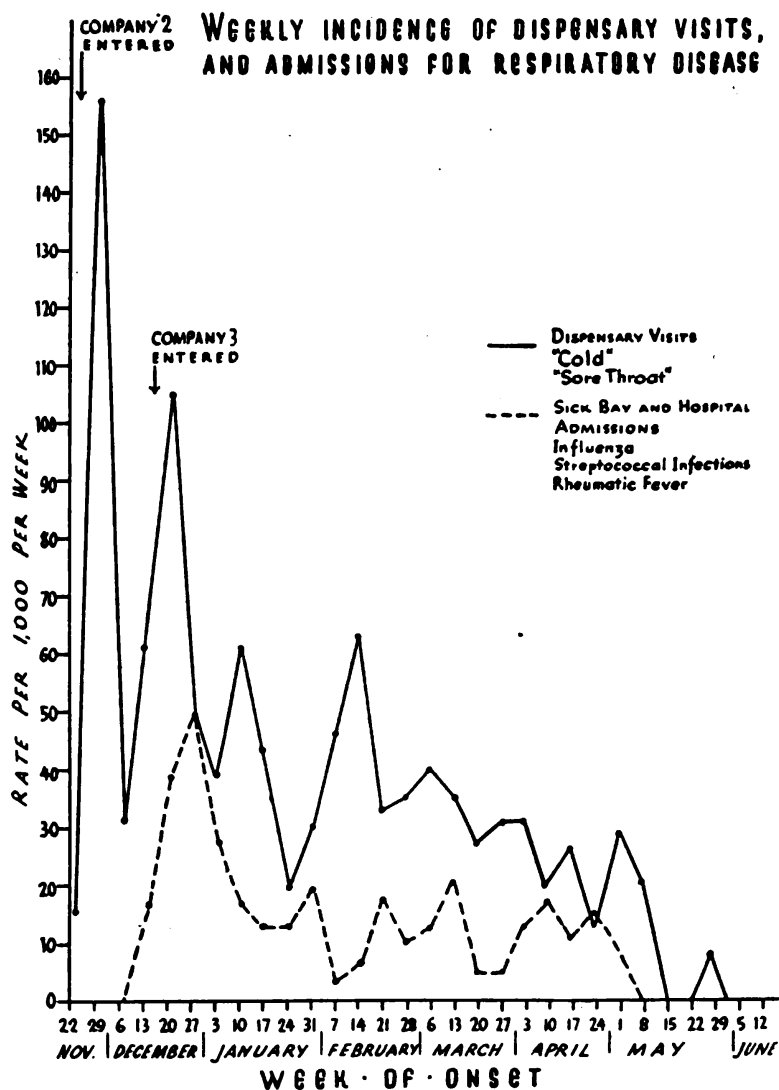


Figure 2.

and was then transferred to Corona for further study and therapy.

Six additional patients were classified as having questionable rheumatic fever. Since there are no specific diagnostic criteria for this disease, when certain of the characteristic signs and symptoms are atypical or lacking it is only possible to make a tentative diagnosis of rheumatic fever. One of these patients had joint pain during convalescence from scarlet fever. Another had similar symptoms associated with an attack of acute pharyngitis. The remaining four had sore throats or colds from 8 to 35 days preceding the development of joint symptoms. Only one of the six had a history which suggested an attack of rheumatic fever in the past.

Presenting signs and symptoms of the disease in the 20 definite cases are shown in table 2. Typically, there was a migrating

polyarthritis attacking knees and ankles most frequently, with pain, swelling, and redness of the affected joint. Cardiac involvement as shown by the electrocardiograph occurred in 11, or 55 percent of the cases, and significant murmurs or cardiac enlargement were found by clinical examination in 8, or 40 percent of the 20 cases.

TABLE 2.—*Percentage distribution of presenting signs and symptoms in acute rheumatic fever*

Presenting signs and symptoms	No. of cases	Percentage of total cases
Epistaxis.....	8	40
Chest pain.....	7	35
Joint involvement:		
One or more joints.....	20	100
Knee.....	16	80
Ankle.....	15	75
Shoulder.....	8	40
Elbow.....	5	25
Wrist.....	5	25
Finger.....	4	20
Hip.....	4	20
Toe.....	2	10

The close association of attacks of acute rheumatic fever with preceding respiratory infections caused by the Group A hemolytic streptococcus is well established. The distribution of the preceding respiratory complaints and illnesses in the present series is shown in table 3. The large number of dispensary visits for sore throat would indicate that this illness, although apparently mild, was streptococcal in origin and capable of precipitating rheumatic fever in those susceptible.

TABLE 3.—*Distribution by diagnosis of respiratory infections preceding onset of acute rheumatic fever*

Diagnosis	Number of cases
Sore throat.....	13
Acute tonsillitis.....	4
Sinusitis.....	2
Scarlet fever.....	1
Otitis media and pneumonia.....	1
Chronic, continuous sore throats and colds.....	5
Total cases, definite and questionable rheumatic fever.....	26

The interval between respiratory infection and development of rheumatic fever was determined in 21 of the 26 definite and questionable cases. The intervals ranged from 6 to 33 days, with most cases developing after from 12 to 18 days. In 5 instances respiratory infections were of such a chronic nature that the interval to the onset of rheumatic fever was impossible to determine.

The relationship of respiratory disease and rheumatic fever to

RESPIRATORY DISEASE BY NUMBER OF WEEKS AT SCHOOL BEFORE ONSET

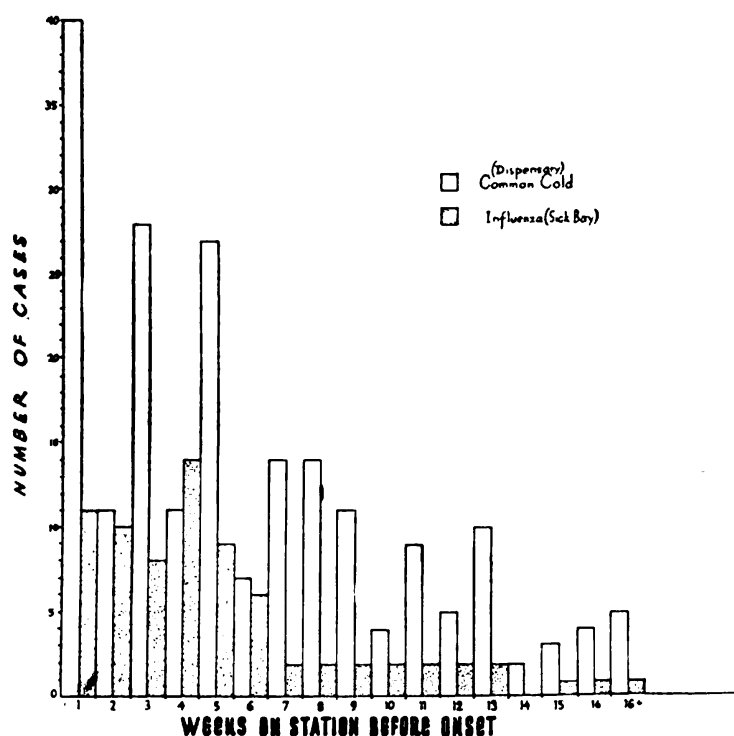
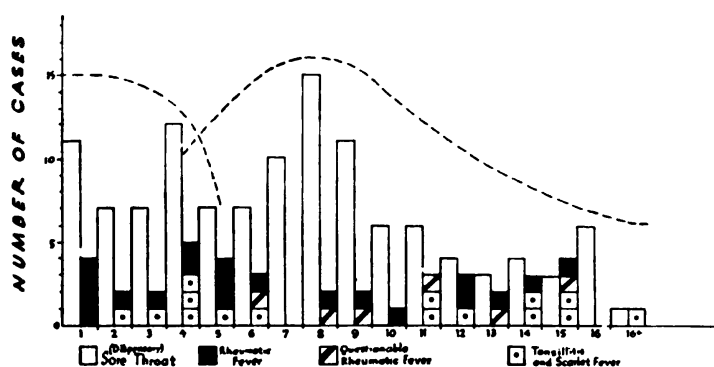


Figure 3.

the number of weeks the patient had been at the school before onset of the disease is shown in figure 3. Again, the relatively high infectiousness of colds and influenza can be seen by their peak of frequency in the first weeks of training.

A more complex pattern is revealed among the streptococcal and rheumatic group of diseases. Two curves of illness are indicated by the broken lines. The first curve represents illness contracted soon after arrival at the school, which in many instances was a continuation of infections originating in the recruit training camp and pre-radio school.

Six of the eight patients developing rheumatic fever in the

TABLE 4.—*Carrier rates for group A hemolytic streptococci from throat culture surveys of the school population*

Date of survey	Number cultured	No. positive for Group A streptococci	
		Number	Percent
25 March, 1944.....	159	45	28.3
27 May, 1944.....	285	93	32.6

TABLE 5.—*Distribution of predominant Group A types among positive throat cultures in surveys of school population*

Group A Types	Number of strains on date of survey		Total
	25 March	27 May	
14.....	18	16	34
3.....	10	14	24
19.....	5	17	22
All other types.....	3	13	16
Untypable strains.....	9	33	42
Total Group A.....	45	93	138

first 4 weeks at the radio school had definite histories of streptococcal illness originating at the previous training station. Another student developed an otitis media 2 days after arrival at the school and it eventually led to rheumatic fever with a fatal outcome. It is highly probable that his original streptococcal infection was a sore throat contracted before arrival. Four other rheumatic fever patients gave a history of chronic sore throats and colds, developing first in the previous training camp. They were hospitalized for rheumatic fever from 5 to 15 weeks after entering the school.

The second wave of streptococcal infection had its peak at about the eighth week. Rheumatic fever cases reflecting the increased frequency of streptococcal infections can be seen to occur throughout the latter months of training. The second peak is thought to represent illness developing among carriers of streptococci which were indigenous to the environment of the school. It has been observed at a Naval training station (1) that carrier rates for group A streptococci and illness caused by this same organism reach a peak among recruits between the sixth and eighth week of training.

A similar peak at the radio school may be attributed to the increasing rapidity of exchange of organisms between carriers and noncarriers. Such a rise in carrier and case incidence is probably accompanied by increasing streptococcal contamination of the dust and air of the barracks.

Two throat culture surveys were carried out on the school

population to determine the carrier prevalence of Group A hemolytic streptococci and the distribution of the serologic types among the Group A carriers. The results of these surveys are shown in tables 4 and 5. The methods of Lancefield and co-workers (2) (3) were employed to determine the group specific "C" substance and the type specific "M" protein.²

The type distribution among carriers in the population as shown in table 5 reveals a predominance of types 3, 14, and 19. It is not known whether particular type strains are especially likely to be precursors of rheumatic fever but the work of Kuttner and Krumwiede (4) on streptococcal types in epidemics among rheumatic children would suggest that certain strains of Group A streptococci are better predisposing agents to rheumatic fever than others which are equally prevalent and capable of causing respiratory infection.

The relative frequency of untypable Group A strains is a phenomenon often encountered in carrier surveys, since the type specific "M" substance is not always present in strains harbored by healthy carriers.

Hemolytic streptococci were isolated from blood agar plates exposed to the air of the sleeping quarters on 5 June 1944 and at the same time samples of dust from dry sweepings in the barracks also yielded hemolytic streptococci when cultured in broth. Of the 21 strains so isolated from the air and dust, 16 were Group C, 2 were Group G, and 3 strains failed to react with any of the known streptococcus grouping sera. It was surprising that no Group A strains were isolated from the living quarters of a population having a 32.6-percent carrier rate for Group A streptococci. No positive evidence of air-borne spread or factors in the physical environment facilitating this mode of transmission were revealed by the tests at this time, which was well past the epidemic peak. The incidence of respiratory disease was essentially the same in upper and lower bunks, and there was no preponderance of disease in any one deck or dormitory. However among the earlier companies a tendency for men to develop similar respiratory infections almost simultaneously in adjacent or nearby bunks was noted.

The school population was investigated as to possible characteristics which might influence resistance or susceptibility to infections caused by the hemolytic streptococcus and to the subsequent development of rheumatic fever, as well as searched for factors in the physical environment tending to favor the spread

² These tests were carried out in the Streptococcus Typing Laboratory of the U. S. Naval Medical School.

of streptococcal infection and resulting rheumatic fever.

TABLE 6.—*Distribution of admissions for respiratory disease and rheumatic fever by age groups*

Age group	Number in age group	Admissions			Total cases	
		Influenza	Streptococcal infections	Rheumatic fever*	No.	Percent
17-19 yrs.	188	34	4	8	46	24.5
20-24 yrs.	247	32	5	11	48	19.4
25-29 yrs.	142	17	3	4	24	16.9
30 and over.	92	6	2	3	11	12.0

* Includes six cases of questionable rheumatic fever.

Respiratory disease rates by age groups, as shown in table 6, indicated a slightly greater susceptibility among the younger men from 17 through 19 years of age, decreasing steadily to the age group of 30 and over. These differences were within the limits of chance variation, except between the youngest and oldest age groups.

TABLE 7.—*Distribution of cases by rural or urban residence from North or South*

Residence	Number in group	Dispensary visits		Hospital admissions			Total admissions	
		No.	Percent	Influenza	Streptococcal infections	Rheumatic fever	No.	Percent
Northern:								
Urban.	453	145	32.0	48	6	17	71	15.7
Rural.	82	24	29.3	8	3	2	13	17.0
Total North	535	169	31.6	56	9	19	84	15.7
Southern:								
Urban.	97	29	29.9	20	2	5	27	27.8
Rural.	35	14	39.0	9	2	2	13	37.2
Total South	132	43	32.6	29	4	7	40	30.4

Includes six patients with questionable rheumatic fever of whom five had northern residences.

Illness by residence in northern or southern states and urban or rural communities (table 7) showed interesting differences. In this analysis southern residence was considered as any state south of the Ohio River and the 37th parallel, and rural residence any town of less than 2,500 population. As has already been mentioned, it is evident that there is a great predominance of northern urban backgrounds among the men at this school. On the other hand, attack rates were higher to a significant degree among southerners, especially among the men from homes in the rural south. However there were too few men from any except northern urban regions for this factor alone to have much effect on the disease rates.

TABLE 8.—*History of previous attacks of rheumatic fever and scarlet fever among patients with acute rheumatic fever in sample of the school population*

Survey group	Number interviewed	Previous scarlet fever		Previous rheumatic fever	
		No.	Percent	No.	Percent
Acute rheumatic fever.....	20	8	40.0	11	55.0
Sample of school population.....	512	104	20.3	11	2.1
Total surveyed.....	532	112	21.0	22	4.1

As a previous history of rheumatic fever adds greatly to the risk of further recurrences of this disease, this information was sought. Four and one-tenth percent gave a history of definite rheumatic fever and by the inclusion of those who gave a history of pain and swelling in the joints the incidence was increased to 7.1 percent. This would indicate a potential reservoir of rheumatic fever, if streptococcal infections were widespread. That such was the case in this school population can be seen in tables 8 and 9. A study of table 8 shows that more than one-half the patients who had rheumatic fever had a history of previous attacks, whereas only 2.1 percent of those not developing rheumatic fever had previous history of this disease. Similarly this table shows that the rheumatic fever group had a higher percentage with a history of previous scarlet fever.

TABLE 9.—*Comparative incidence of acute rheumatic fever among those with and without history of previous attacks*

Rheumatic fever history	Number interviewed	Current rheumatic fever	
		No.	Percent
Previous attack.....	22	11	50.0
No previous attack.....	510	9	1.8

In table 9 this information is expressed somewhat differently, namely, as the incidence of acute rheumatic fever in the present outbreak among those with and without previous personal history of the disease. These ratios may be considered as probabilities of an attack of rheumatic fever at the radio school in the winter of 1943 to 1944; a 50-percent chance of an attack among those with histories of previous rheumatic fever and a 1.8-percent chance among those without such histories.

Because throat swabbings were not made in this series of respiratory illness, it is impossible to determine with accuracy the percentage of streptococcal infections followed by rheumatic fever. However if all complaints and admissions for sore throat,

tonsillitis, and scarlet fever at the radio school are considered as streptococcal in origin, the incidence of rheumatic fever in this group is 12.5 percent, a figure close to the mean of 11 percent determined by Paul (5), in a compilation of recorded outbreaks of streptococcal infection and rheumatic fever in nonrheumatic populations. The 22 persons in the present study having a definite past history of rheumatic fever might be considered a rheumatic population. Among these were 16 respiratory infections presumably streptococcal in nature and 11 cases of acute rheumatic fever, 69 percent of the streptococcal infections later developing rheumatic fever. There is great variation in the amount of rheumatic fever developing from outbreaks in rheumatic populations (4) (6).

In summary, the extremely high rate of rheumatic fever in the school population studied may be considered to have been the result of a very high incidence of streptococcal infection, which was relatively mild as far as respiratory symptoms were concerned. A predisposing factor in the outbreak was the previous history of rheumatic fever among 4.1 percent of the school population.

In many cases the streptococcal illness leading to rheumatic fever was contracted while the men were stationed at a training camp prior to entering the radio school. To a large extent the epidemic patterns at the radio school were determined by infections carried over from this training camp. In general, a concentration of epidemiologic control measures against rheumatic fever would seem indicated in the technical training schools.

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PENICILLIN IN PERSISTENT DIPHTHERIA

TREATMENT OF PATIENTS WITH REPEATED POSITIVE THROAT CULTURES

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During August, September and October of 1944, there was an outbreak of diphtheria in several companies in Camp Waldron at the U. S. Naval Training Center, Farragut, Idaho. In the epidemiologic report for the month of October the organism was identified as *Corynebacterium diphtheriae* of the intermediate type.

There were 24 cases of diphtheria and 16 diphtheria carriers reported on the station. Approximately 40 diphtheria patients and carriers were admitted to the hospital. Ten patients either did not show positive cultures on admission, or their cultures soon became negative; these 10 are not included in the following report. Of the remaining 30 patients, 28 were treated with penicillin.

A problem arose in the care of the diphtheria patients and carriers in that their throat cultures remained positive after all other signs and symptoms had subsided. In Fleming's original report it was noted that penicillin had a bacteriostatic effect on the *Corynebacterium diphtheriae*. It was therefore decided to administer penicillin in various doses.

Before penicillin was administered the cultures were tested and all found to have toxin-producing properties. Guinea pigs could not be obtained, so rabbits were used with very gratifying results; the procedure was the same.

A few patients were given penicillin in the first few days of hospitalization but the majority had been in the hospital 15 or more days before penicillin was given. Throat cultures were taken at frequent intervals. Penicillin was given by the intramuscular route in courses consisting of 25,000 units, 50,000 units, or 100,000 units daily; the 100,000-unit dosage was given to those who did not respond to the smaller dosage.

Many of the patients had enlarged tonsils, and tonsillectomies were performed on 16 patients after the throat cultures became negative and on 2 patients before negative cultures could be obtained. However these latter 2 patients did not receive a repeat course of 100,000 units of penicillin.

RESULTS

Three patients received 25,000 units of penicillin daily, and all cultures remained positive. The average number of days under treatment was 13.5, and treatment was started on an average of 26.3 days after admission. Two of these patients received further treatment with 100,000 units of penicillin daily, whereupon the throat cultures became negative and remained so. One patient was under treatment with 100,000 units of penicillin daily for 5 days and the other for 14 days.

Twenty patients were treated with a daily dosage of 50,000 units of penicillin with good results in 12 instances; in the remaining 8, cultures remained positive. Of these latter patients 6 received courses of 100,000 units of penicillin, whereupon all cultures became negative and remained so. The remaining 2 patients had tonsillectomies before their cultures became negative. The average number of days under treatment was 16.15, with 7 days being the shortest and 28 days the longest number of days under treatment. The average period of hospitalization before treatment was instituted was 22.5 days.

Five patients were treated with 100,000 units of penicillin daily with good results in four instances. One patient who received 100,000 units of penicillin and 20,000 units of antitoxin had a persistent positive throat culture. Five patients were treated in the acute stage with 100,000 units of penicillin and one patient with 50,000 units, with good results in three patients and positive throat cultures persisting in two. One of the latter received, in addition, 20,000 units of diphtheria antitoxin.

Seven of the original 30 patients were treated with diphtheria antitoxin soon after admission, the dosage varying from 10,000 to 40,000 units. One patient treated with 10,000 units of antitoxin on admission and 50,000 units of penicillin for 26 days, still had a persistent positive throat culture, and not until a second course of penicillin, consisting of 100,000 units daily, had been administered, did the throat culture become negative.

One patient received 40,000 units of diphtheria antitoxin, and the throat culture became negative within 14 days. Another patient received no treatment, yet the throat culture became negative in 15 days.

COMMENT

The results obtained from this study suggest that penicillin does have a bacteriostatic effect in diphtheria patients and diphtheria carriers. The daily dosage of penicillin from which the best result was obtained was 100,000 units. Four patients responded to the 100,000-unit daily dosage and one patient failed

to respond. Of the 20 patients treated with the 50,000-unit daily dosage, 12 (60 percent) had negative throat cultures and 8 (40 percent) did not respond. Six of the patients who failed to respond to 50,000 units of penicillin daily did respond to a second course consisting of 100,000 units daily. Three patients treated with 25,000 units of penicillin daily had throat cultures persistently positive for *Corynebacterium diphtheriae*; two of these responded to a second course consisting of 100,000 units.



BIOSYNTHESIS OF NICOTINAMIDE

The urinary nicotinamide methochloride elimination was determined in 8 persons before, during and after the administration of succinyl sulfathiazole in 5 patients and of sulfathiazole in 3 cases. Succinyl sulfathiazole diminished the urinary nicotinamide methochloride output on the average by 60 percent, while sulfathiazole caused only a small reduction. This is interpreted as demonstrating a biosynthesis of nicotinamide in the gut. Succinyl sulfathiazole does not interfere with the methylation of ingested nicotinamide.—ELLINGER, P., and BENESCH, R.: Biosynthesis of nicotinamide in human gut. *Lancet* 1: 432-434, April 7, 1945.



GENITAL COMPLICATIONS FROM DENGUE

In studying 141 male patients recovering from dengue fever, 8 or 5.7 percent gave conclusive signs or history of involvement of the urogenital tract. Five suffered from a dengue orchitis, 3 with subsequent atrophy of the testis. Five patients experienced repeated bloody seminal emissions during the first few months of convalescence. In 2 cases, this latter finding was confirmed by laboratory examination of the spermatic fluid.

It was noted that atrophy of the testis sometimes occurred following minimal swelling of the testis. This observation casts doubt on the common assumption that atrophy is caused by compression of the testis incident to tremendous engorgement within its inelastic capsule. Our studies indicate that an active pathologic process may persist in the urogenital tract for several months following the acute febrile phase of dengue fever, as evidenced by hemospermia and progressive atrophy of the testis.—WEYRAUCH, H. M., and GASS H.: Urogenital complications of dengue fever. *J. Urol.* (In press.)

DIPHThERITIC PARALYSIS

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and

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Ten cases of diphtheria or its complications have been treated in this hospital since its commissioning. Of this number 5 cases have been complicated by some form of paralysis which was thought to be due to diphtheria. The high incidence of this complication attracted attention. It is the purpose of this article to present an analysis of these 10 cases with particular reference to paralysis.

All the patients were white males; they ranged in age from 18 to 27 years with an average of $22\frac{1}{2}$ years. There was only one positive Schick test recorded for this group. There was no record of any of these patients having had immunization with diphtheria toxoid.

The diagnosis was established in seven cases by positive cultures. In two cases the diagnosis was established aboard a hospital ship and the records reported only positive smears. The clinical pictures in these two cases seemed to substantiate the diagnosis. One case was not diagnosed as diphtheria during the acute phase of the illness. The patient was treated on an outlying island and apparently facilities for making cultures were not available. In this case the spirilla and fusiform bacilli typical of Vincent's angina were found on direct smear and the case was diagnosed and treated as such. No diphtheria antitoxin was given. The subsequent development of a severe paralysis which seemed typical of the post-diphtheritic type, and notes in his health record made at the time of the acute illness describing severe edema of the pharynx and large membranes on both tonsils, have led to the conclusion that this patient had diphtheria as well as the Vincent's infection.

It is possible that the finding of Vincent's organisms on the direct smear led to some confusion in the diagnosis. In two cases treated during the acute illness in this hospital, the report of Vincent's organisms found on direct smear led to some confusion in diagnosis and delay in treatment. In both cases direct smears

showed the Vincent's organism and later cultures showed the *Corynebacterium diphtheriae*. These two patients and the one who received no antitoxin had paralysis as a complication.

All of the patients with diphtheria except one were treated with antitoxin. The time elapsing between the onset of symptoms and the administration of antitoxin is of interest. In the five patients with paralysis the earliest administration of antitoxin was on the fifth day of illness and the latest on the ninth day; one patient did not receive antitoxin. The average for the four patients receiving antitoxin was 7 days. The five patients who did not have paralysis received antitoxin anywhere from the first to the third day.

The dose of antitoxin used was somewhat smaller for the patients who did not develop paralysis. They received from 15,000 units to 40,000 units, the average dose being 23,000 units. The four patients in the group having paralysis who were given antitoxin received doses ranging from 40,000 units to 80,000 units with an average dose of 60,000 units. Five patients were given a sulfonamide. Three of these cases were in the group showing paralysis. Sulfonamides were administered to all three of the patients who had Vincent's infection. One of these patients was given two doses of mapharsen intravenously and one had neoarsphenamine applied locally. Various gargles were used. Multivitamin capsules and thiamine chloride were administered to the patients convalescing from paralysis.

The paralysis which developed in five instances fits the textbook description fairly closely. The earliest case began 16 days after the onset of the illness and the latest 48 days after. The average onset was 36 days after the beginning of the disease. In all cases the initial paralysis involved muscles of the head and neck. Four patients showed pharyngeal involvement first. Attention was called to this by a peculiar nasal quality of the spoken voice and by water regurgitating through the nose.

In one instance the initial sign of muscle weakness was blurring of vision. Two other patients complained of blurring of vision, and one of diplopia. One patient exhibited paralysis of the vocal cords; three had great weakness of the legs, and one only slight weakness. The paralysis of the extremities followed the initial paralysis in from 1 to 6 weeks. In one instance the paralysis could be observed progressing from the pharynx to the arms and finally to the legs. The pharyngeal involvement preceded the leg involvement by 2 weeks and had begun to clear when the latter appeared. One patient complained of the slightest pain in the calves of his legs at the onset of paralysis. No sensory changes were noted in any of the others. In this respect the cases fit the

textbook picture of a painless peripheral neuritis which begins in the muscles of the head or neck and progresses downward to the lower extremities.

In one case there was serious involvement of the heart muscle with circulatory failure on the twelfth day of the disease. An electrocardiographic tracing showed evidence of a bundle branch block and had an inverted T in lead one. The clinical symptoms of heart disease gradually improved and on the fifty-third day of the disease electrocardiographic findings were normal. No other patients showed any clinical evidence of heart disease, but electrocardiograms were made on four of this number. Two showed significant changes, namely, a prolonged P-R interval in one case and depressed S-T segments in leads 2 and 3 and a changing T_3 on serial tracings in the other. These changes reverted to normal. The three patients who showed involvement of the heart muscle also had paralysis.

The progress in the paralyzed group has been slow improvement. Two patients who had only slight involvement have recovered completely. Two have been surveyed back to the United States. A follow-up report on one stated that he was still a bed patient after $4\frac{1}{2}$ months. One of the patients who had marked paralysis is still in the hospital. He has shown some improvement, but the weakness of his legs still prevents his walking after 3 months.

COMMENT

The paralysis and heart muscle involvement shown in these cases is not different from the textbook picture. The incidence of paralysis does seem high. An analysis of the records suggests very strongly that delay in administration of antitoxin was an important factor in those cases in which paralysis developed. The fact that Vincent's organisms were found on a direct smear seemed to be a cause for some delay in administering antitoxin. The possibility that these organisms can be present simultaneously with a diphtheritic process should be kept in mind.

FAMILIAL PORTAL CIRRHOSIS IN YOUNG ADULTS

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The occurrence of two cases of portal cirrhosis in young adult members of the same family would seem to be of sufficient interest to warrant reporting. A review of the standard textbooks has thrown but little light on the cause and frequency of this condition. Karsner (1) makes the statement that Laënnec's cirrhosis is principally a disease of males and of middle life and sometimes appears to be familial. Quoting Moon, this author states that infectious diseases often precede the development of juvenile cirrhosis but that this is not typical of Laënnec's cirrhosis.

Osler (2) notes that "cirrhosis in children is by no means rare. Usually it is of the common or portal type . . . It is due to usual causes and is not uncommon in several members of the same family, which may be due to familial habits as regards alcohol, etc., and to the influence of congenital syphilis, which, although cured, may leave the liver susceptible to the common causes of portal cirrhosis."

Boyd (3) lists healed acute yellow atrophy as a subgroup of portal cirrhosis and believes that many cases of so-called alcoholic cirrhosis in children belong to this category. In such cases he notes that there is frequently a history of repeated attacks of jaundice with, perhaps, pain, fever, and vomiting. This author stresses the fact that no single cause of portal cirrhosis can be recognized, and that the disease is the result of parenchymatous injury followed by repair, so that any agent which produces chronic diffuse hepatitis may result in cirrhosis. He cites the experience of Moore who has found streptococci in sections of the liver in acute cases of cirrhosis in children.

In a recent symposium on hepatic cirrhoses Karsner makes the following pertinent observations: (1) There was general agreement (at the first conference of the International Society for Geographic Pathology held in 1931) that the disease is inflammatory and more or less continuously progressive; (2) cirrhosis in infancy, childhood, and adolescence is unusual; (3) it may be due

Data on living siblings of the two patients

Name	Sex	Present age	Remarks
J.P.B.	Male	16	Pale, nervous, complains of insomnia and easy fatigue.
E.B.	Female	20	Very unhealthy, complains of postprandial abdominal pains, weighs less than 100 pounds, nervous. A premature child (7 months) who was jaundiced at the age of 6 weeks.
J.M.B.	Male	23	On duty with armed services overseas. Had stomach-aches and constipation before leaving home.
M.B.	Female	27	Very nervous, postprandial abdominal discomfort, constipated.
W.B.	Male	29	Very nervous, has been treated for stomach ulcers, now in Army but has been losing weight for past 10 months.
J.B.	Male	32	Looks pale and tired, has frequent epistaxis and has postprandial abdominal discomfort.
L.E.B.	Male	33	Unhealthy, complains of chest pain, but x-ray findings of lungs are negative for tuberculosis.

to congenital syphilis, to congenital atresia or malformation of bile ducts, to infectious disease or to unknown factors; (4) cirrhosis of the liver may occur from childhood to old age with the beginning of its peak of incidence occurring in the fourth decade, attaining its highest point at about the age of 50, then falling off.

Academic interest in the patient seen here was stimulated when the mother volunteered the information that another son had died of a similar condition. Through the cooperation of Drs. Edgar Pund and J. Dewey Gray of the University Hospital, Augusta, Georgia, the records of the second case were made available and are included.

There were 12 children in this family, of whom 3 died at birth; two of these were premature infants and the cause of death in the third is not known. The data on the other living siblings was obtained from the mother by letter and is shown in the accompanying table. The father, aged 73, is living and well except for hypertension. The mother, aged 62, is living and well.

CASE REPORTS

Case 1.—A seaman, second class, age 21 years, was admitted at 2215 on 29 August 1944 complaining of upper abdominal pain which began insidiously following the noon meal and was followed by nausea and vomiting. The pain then became localized in the right upper quadrant just below the rib margin, in the right costovertebral angle, and in the left side of the abdomen just above the umbilicus. The abdomen became moderately distended; this distention and the pain were somewhat relieved by an enema just before admission.

A history of repeated attacks of postprandial epigastric pain for the past year, "sour stomach," and frequent postprandial emesis was obtained. There had been no loss of weight or strength and no change in bowel habits. The patient had always been moderately constipated and stated that he was rather "nervous." Previous serious illnesses, injuries, and operations were denied. He had not been out of the United States. His induction blood Kahn was negative.

Physical examination revealed him to be well-nourished and well-developed. The face was flushed. The temperature was 101° F.; the pulse rate 112 and respirations 20 per minute. He answered questions readily and intelligently. The skin and mucous membranes showed no evidence of icterus. The findings on physical examination were essentially negative except for the abdomen, which was somewhat distended with marked tenderness in the right upper quadrant at the costal margin, the right costovertebral angle, the epigastrium, and to the left of the umbilicus. Rebound pain was present over the entire abdomen. There was some muscle guarding in the upper abdomen, especially on the right side. No organs or masses were palpable. Slight tenderness in both iliac fossae was elicited on rectal examination.

On admission the hemoglobin concentration was 78 percent; the erythrocytes numbered 4,370,000 per cu. mm., and the leukocytes 14,150, with a differential of 9 band forms, 71 segmented cells, 14 lymphocytes, 4 eosinophils, 1 basophil, and 1 monocyte. The urine was normal.

An enema was given without much relief of symptoms. Six hours after admission the abdominal distention and pain increased. A leukocyte count 12 hours after admission showed 12,000 cells with 14 band forms and 65 segmented cells. The abdomen was definitely more distended, the right upper quadrant tenderness more acute, spasm of the right rectus was present, and a fluid wave was demonstrable. A flat plate x-ray examination of the abdomen did not disclose pneumoperitoneum and the lung fields were normal.

Exploratory laparotomy was considered advisable and was carried out under spinal anesthesia 14 hours after admission. On opening the peritoneum an estimated 1,500 cc. of free turbid fluid escaped. The omentum was somewhat thickened, definitely granular to the touch, and its blood vessels were engorged and distended. The liver was contracted and of a light yellow color; it was very hard and studded throughout with hobnail nodules. The gall-bladder was bluish in color, distended, and could not be emptied by manual compression. No calculi were palpable. The pancreas felt harder than normal and the spleen was softened. The stomach and intestines were distended. The appendix was retrocecal and not inflamed.

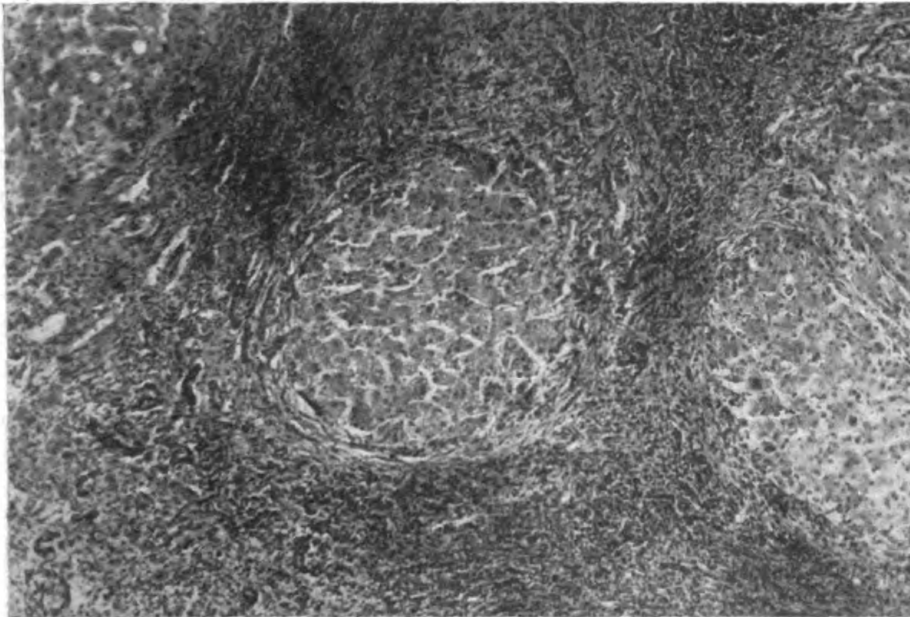
The patient's postoperative condition was poor and there was profuse drainage from the incision. Within 24 hours the abdomen was greatly distended. The temperature at this time was 101° F., the pulse rate 124, and the respirations 24 per minute. Clinical icterus became apparent and an icteric index taken 36 hours postoperatively was reported to be twenty-five.

On the third postoperative day the toxemia became more pronounced and the patient became wildly irrational at intervals. Blood studies made during the morning showed the carbon dioxide combining power to be 45.9 volumes percent; the diastatic activity 6; the icterus index 41; van den Bergh reaction 3 milligrams per 100 cc. delayed direct reaction; the cholesterol 160 milligrams percent; chlorides 519.7 milligrams percent (as sodium chloride); the nonprotein nitrogen 39.8 milligrams percent; globulin 3.08 grams percent; serum protein 6.45 grams percent; the albumin-globulin ratio 1.1:1; the blood urea nitrogen 19 milligrams percent; the prothrombin time 54.5 minutes, and the clotting activity 77 percent. The hemoglobin concentration was 91 percent; the erythrocytes numbered 4,670,000 per cu. mm. and the leukocytes 15,500, with 14 band forms, 77 segmented cells, and 9 lymphocytes. The hematocrit reading was forty-one.

Later in the day these findings were essentially unchanged except for a decrease in the values reported for the van den Bergh test, icteric index, dia-



1. Inferior surface of liver (case 1).



2. Photomicrograph of liver (case 1).

static activity, and globulin. The patient expired on the fourth postoperative day.

The pertinent necropsy findings included: An icteric tinge to sclera and skin; approximately 3,000 cc. of clear, thin, yellow fluid in the peritoneal cavity; marked edema of the abdominal tissues with dilatation of the venous system throughout; generalized adenopathy of the mesenteric nodes; evidences of numerous hemorrhagic areas on the visceral pleura with patchy consoli-

dation throughout both lungs: dilatation of the esophageal veins; and moderate distention of the stomach and intestines, with increased prominence of the lymph follicles in the lower ileum. The spleen weighed 520 gm., the capsule was slate colored, the organ was softer than normal, and the cut surface was deep purple in color and very friable. The liver weighed 1,950 gm., the surface was firm, yellow and grossly nodular (figs. 1 and 2); the gallbladder was moderately distended, and the wall slightly thickened with intact mucosa to which were attached a number of small yellow deposits; the bile was thick and dark and could not be expressed manually although exploration of the ducts revealed them to be patent. The pancreas was grossly normal but microscopically showed some edema of the interstitial tissue with occasional polymorphonuclear leukocytes, plasma cells, and round cells invading these structures.

Case 2.—The brother of the patient cited in case 1, age 21 years, had been admitted to the University Hospital, Augusta, Georgia, on 22 July 1940 complaining of epistaxis and abdominal pain of 8 months' duration. The pain bore no relation to meals, although he had occasional postprandial nausea and vomiting which on two or three occasions contained blood clots. The epistaxis occurred two or three times a day. He had consulted the family physician who placed him on an ulcer diet, but the diet gave no relief and had been discontinued some time before the patient's admission to the hospital.

He denied having bloody stools but complained that his bowel movements were yellow and contained mucus. He had been taking medicine for constipation and stated that he had severe backache when his bowels moved. The week before admission he began to have pain in his right side, and vomited blood on one occasion. Two days before admission he had a severe epistaxis and also vomited about a quart of fresh blood which contained some clots. He had lost 25 pounds in the past 8 months.

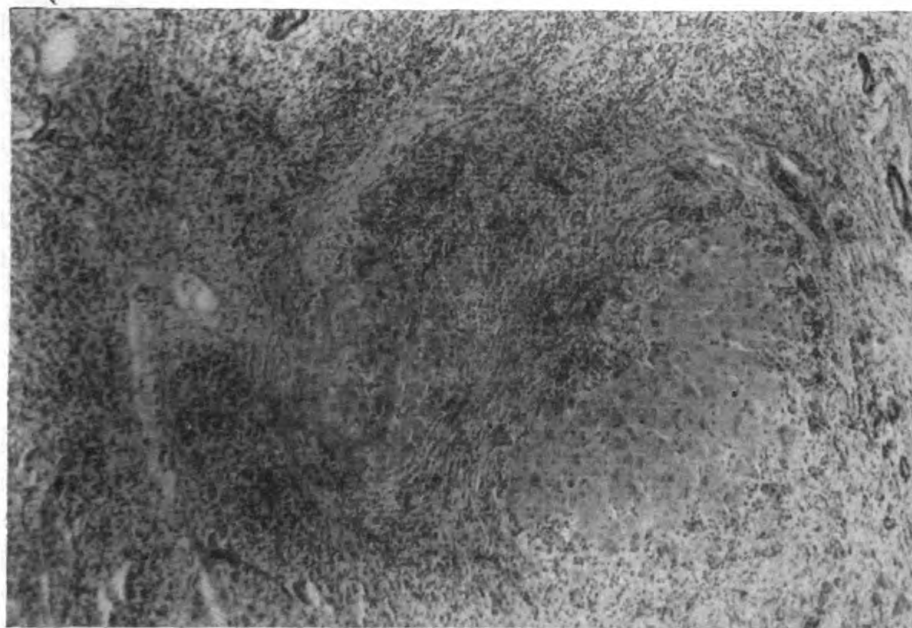
The previous medical history noted measles, whooping cough, and chickenpox in childhood, mumps with complicating orchitis in adolescence, and hookworm infection 4 years prior to admission. He worked as a presser and was on a general, regular diet but with no tea, coffee, or pepper.

Physical examination revealed the patient to be poorly nourished and apparently in pain. The temperature was 100° F., the pulse rate 90 and respirations 18 per minute. The skin was warm and moist with an icteric tinge and there were scattered small red nodules, about 3 mm. in diameter, over the right hand and wrist. The mucous membranes were pale with a yellowish tinge. A loud systolic murmur was heard over the pulmonic area of the heart. The abdomen was slightly distended, the spleen was palpable 6 cm. below the costal margin; no tenderness, rigidity, or masses were felt. The physical findings were otherwise essentially negative.

Complete laboratory findings are not available, but it is noted that the blood Wassermann and Kahn tests were negative and the icteric index was twenty-five. The van den Bergh direct reaction was 2.8 milligrams, blood sugar 70, and blood nonprotein nitrogen 38.7.

Despite general supportive measures, including blood transfusions, the patient became steadily worse and expired 3 days later.

Necropsy was limited to the abdomen with the following pertinent findings: There was a yellowish tinge to the sclera. The abdomen was somewhat distended; the peritoneal cavity contained approximately 1,000 cc. of clear light-colored fluid; the liver weighed 1,180 gm., was very hard, and the capsular surface was universally nodular (hobnailed), the cut surface coarsely granu-



3. Photomicrograph of liver (case 2).

lar, due to innumerable yellowish to yellowish-brown islands of parenchyma surrounded by fibrous bands. The gallbladder contained about 30 cc. of dark, thick mucoid bile; the coats were sound, the ducts patent. The spleen weighed 510 gm.; the capsule was smooth and of normal consistency; the cut surface was purplish red and slightly granular, the lymph nodules being barely visible.

In the esophagus there were two small openings in varices just above the cardia. The stomach contained 1,000 cc. of dark red blood, and a large quantity of blood in various stages of digestion was present in the intestines. The pancreas was considerably harder than normal and felt nodular: the cut surface was pale yellow, and the lobulation was exaggerated; the trabeculae were increased in thickness. The microscopic changes were consistent with those of chronic interstitial pancreatitis with interstitial fibrosis and lymphocytic and plasma cell infiltration.

The similarity of the histologic picture in the two cases is apparent in the accompanying photomicrographs (figs. 2 and 3).

COMMENT

The causative factor is not apparent in either of these cases. While it has been suggested that they may be examples of Wilson's disease, pigmentation at the margin of the cornea was absent, and the clinical symptoms said to be present in this condition (tremor, dysphagia, contractures of the extremities, psychic manifestations) were not observed. Unfortunately an examination of the basal ganglia was not made in either case.

It is interesting to speculate on the possibility of the Rh factor as the causative agent in these cases. Hawksley and Lightwood (quoted by Karsner) have suggested that erythroblastosis foetalis might give rise to juvenile cirrhosis, but the age of the pa-

tients in this report would seem to militate against such an hypothesis here. In addition the history was obtained that of the 12 children in this family, only 3 died in infancy and in none of these was there a definite history of jaundice. Of the remaining 9 siblings, all of whom attained maturity, although they were all "rather yellow when very young," only one (a premature infant born at 7 months) has a history of having been definitely jaundiced in childhood. For these reasons it would seem that this possibility could be dismissed.

SUMMARY

Two cases of portal cirrhosis in young adult male siblings are reported. Death occurred at the same age and the necropsy findings were strikingly similar. The causative factor is not apparent. The symptoms presented by the other siblings suggest that some of them at least may have a similar condition.

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3. BOYD, W.: The Pathology of Internal Diseases. 2d edition. Lea & Febiger, Philadelphia, 1935. p. 327.
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THIOURACIL IN ANGINA PECTORIS

Treatment with thiouracil proved effective in 7 out of 10 patients with angina pectoris, 4 of whom became entirely symptom free during the treatment.

Clinical improvement coincided rather closely with the fall of the metabolic rate and failed to occur in those patients whose basal metabolic rate did not decrease.

The thyroid hormone, even in physiologic amounts, sensitizes the heart muscle to the anoxiating toxic action of epinephrine. Thiouracil exerts an opposite, heart-protecting effect, obviously through suppression of thyroid hormone formation.

In view of these and many other experimental and clinical facts the efficacy of "functional thyroidectomy" through thiouracil is ascribed to a diminution of myocardial sensitivity to heart-anoxiating, angina-producing epinephrine and sympathin discharges.—RAAB, W.: Thiouracil treatment of angina pectoris, rationale and results. *J.A.M.A.* 128: 256, May 26, 1945.

STANDARDIZED CLINICAL PHOTOGRAPHY

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In dental clinical photography, recent methods have utilized the bracket table as a location for the camera-light unit to replace the tripod or specially built camera stands. While the bracket table mounting is probably an improvement, it still necessitates time-consuming adjustments of the subject, the chair, and usually the light source. Focusing is also required before the exposure can be made.

Variation in lighting conditions is not desirable in clinical photography of the "before and after" type. The results of lighting variation have been criticized in "before and after" pictures in dermatology and plastic surgery; the "after" photographs sometimes allegedly receive more favorable lighting conditions than the "before." Standardization of lighting would eliminate this situation, whether it be intentional or not. With the equipment to be described, lighting variations may be eliminated completely.

The focusing operation, and the attendant adjustment of the bracket table and chair may also be eliminated, with the result that clinical photography can be so simplified and practical that its routine use is possible, instead of setting the equipment aside, and using it only occasionally. The clinical camera described here has been used in dentistry, dermatology, surgery, and ear, nose and throat work. The advantages of this equipment are as follows:

1. *Speed.*—The complete procedure of making a photographic record is accomplished in less than 1 minute.

2. *Accuracy.*—The field covered is ample to allow some error without cutting off the center of interest. Field determination and focus are almost automatic. Retakes are almost unknown.

3. *Simplicity of design and operation.*—The unit is hand-held, readily portable, and is complete in itself; no auxiliary equipment is used. There are no delicate parts to get out of order.

4. *Convenience.*—The unit is small, compact and lightweight. The camera may be quickly removed from the unit if needed for other uses. While primarily designed for Kodachrome film, the equipment will also produce excellent results in black and white. It will photograph models, restorations, appliances or instruments

at close range, as well as various intra-oral views without adjustment.

5. *Standardization.*—The pictures are always uniform as to the size of the field covered, illumination intensity, and color temperature.

OPERATION OF THE CAMERA

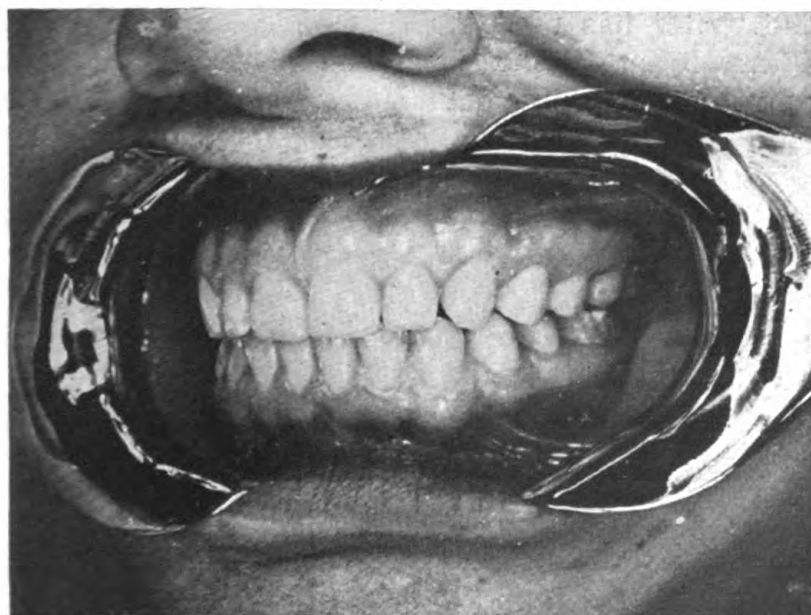
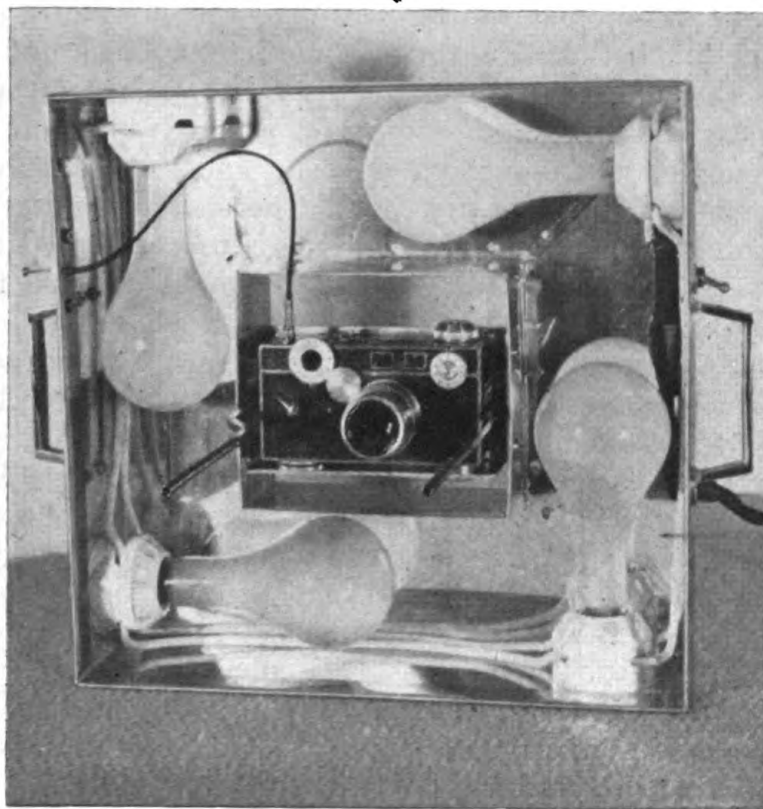
Because Kodachrome Type A film is intended for use with artificial light, the blinds should be drawn in the operating room before the picture is taken. This should be done also when using black and white film to prevent variations in light intensity. A totally darkened room is not necessary. The shutter is cocked and the plug connected to an electric outlet. Cheek retractors are placed by the operator and held by the patient (or the assistant) in the required position.

The flat handle portions of the retractors are lined up in the same plane with that portion of the subject nearest to the lens. This one rule is all there is to remember in the placing of the retractors; but it is very important if all parts of the picture are to be in focus. Any part of the subject closer to the lens than the tips of the focusing rods or the imaginary line between these points will not be in focus.

The tips of the focusing rods are placed in light contact with the handles of the cheek retractors, equidistant from the vertical midline of the subject. This establishes the vertical borders of the picture, since each focusing rod lies just outside of the field covered. The imaginary horizontal line between the focusing rod tips bisects the horizontal dimension of the picture. The rod tips are lined up to place this bisector in coincidence with the desired horizontal midline of the picture. In the case of a frontal intra-oral photograph of the teeth in occlusion, this would be the occlusal plane; or, in an occlusal view, half the distance between the incisal edges of the central incisors and the last molar teeth.

When the field to be covered in the picture has been lined up, the patient is instructed to close his eyes to avoid the glare of the intense illumination which is to come. The switch is snapped on, and as soon as the subject is quiet and the camera steady, the shutter is released. The switch is then snapped off, and the film is advanced for the next picture. Both the switch and shutter releases are conveniently located on the reflector body at the thumb level of either handle. For this reason it is unnecessary for the operator to divert his attention from the placing of the focusing rods as described above. The operator looks directly over the top of the camera in sighting the picture, and at all times sees the picture almost as it appears in the camera.

1. The unit complete.



2. A black and white photograph made with this equipment.

The name of the patient and the date should be recorded on a record card opposite each film number, or a sticker bearing the patient's name or a code number may be placed on a retractor and photographed as part of the picture. Except for changes in

diaphragm and shutter settings, the procedure for making the picture is the same for Kodachrome or black and white film.

In the 35-mm. black and white film, enlargement is required for satisfactory prints. Projection prints from 35-mm. negatives are made by photofinishers as easily and economically as are contact prints from larger negatives. These enlargements should be made on contrast paper. Kodachrome is processed by the manufacturer and returned in the form of mounted positive full color transparencies. These may be projected on a light wall or special screen, or viewed as enlargements in a Kodachrome viewer. The Kodachrome transparency in a close-up intra-oral photograph is very satisfactory, however, without enlargement. An x-ray viewing box is ideal for viewing Kodachrome.

The full color transparency is a much better medium for intra-oral work than the black and white print because the color affords contrast between the teeth and the soft tissues, and shows much finer detail of defects in the enamel, such as stains, cracks, contour and so forth. The full color photograph of inflammation dwarfs the black and white picture as a clinical record by comparison. This is true in the fields of dermatology and allergy as well as in dentistry.

PHOTOGRAPHIC DATA

Camera.—The writer has used the Argus C2 camera in this unit, and the drawings, specifications, and photographic data given here apply to this equipment. However, any 35-mm. or Bantam camera which has a color-corrected lens, a one-twentieth second shutter speed, an f. 12.7 diaphragm opening, and a 3- or 3½-foot setting, and which can be fitted with front lenses as specified, or a suitable lens extension tube or telephoto lens, may be well adapted to this unit.

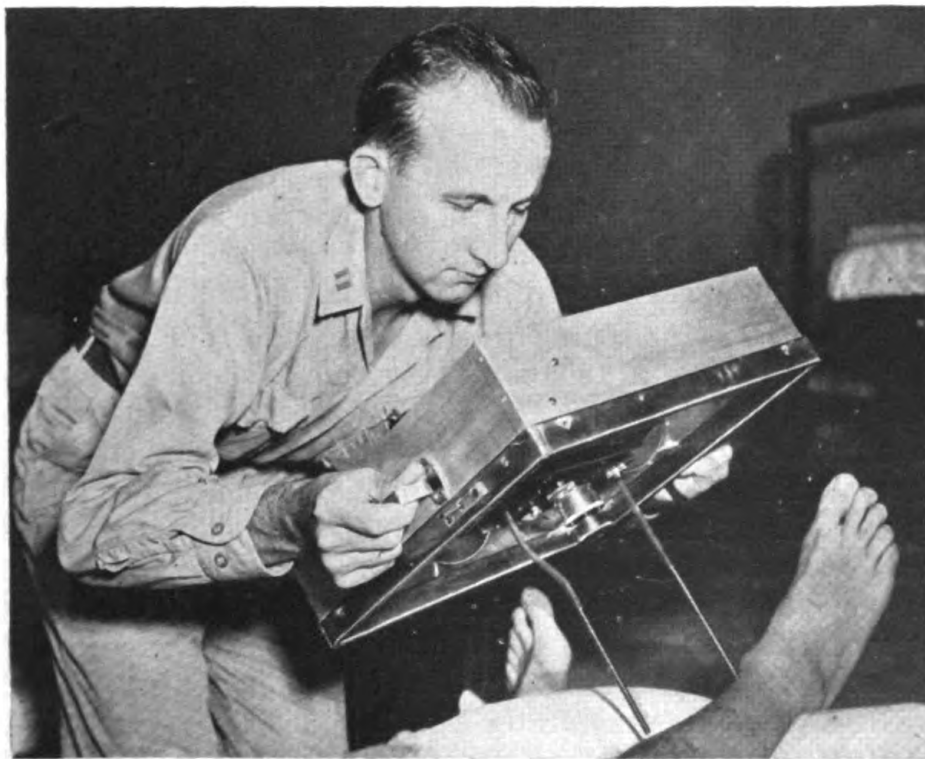
Table of subject distance and approximate field size for 35-mm. cameras equipped with 50-mm. focal length lenses (camera set at 3½ feet)

Kodak Portra lens	Field (inches)	Subject distance (inches)
1+.....	6¾ by 10	21
2+.....	6½ by 9½	13¾
3+.....	4½ by 6¾	10 ¼

Lenses and extension tube.—In addition to the standard Argus Cintar 50-mm. f.3.5 lens, one 2+ diopter and one 3+ diopter Kodak series V Portra front lens are used. These are mounted in a Kodak adaptor ring, series V, No. 18 (screw type) with a Kodak retaining ring, series V, to accommodate the second lens. This gives a total front lens correction of 5+ diopters. The camera is set at 3



3. Camera position in taking an intra-oral photograph.



4. Camera position in taking photograph of a lesion on the leg.

feet. This arrangement gives a working distance of $6\frac{1}{2}$ inches from the front lens mount to the subject, and the field covered is

3 by 4½ inches. This field has been found to be the best size for intra-oral work. When a larger field is desired, the picture may be taken at a greater distance from lens to subject, using a 4+, 3+, 2+, or 1+ diopter front lens.

For a still larger field, the 3-foot setting on the camera without front lenses may be used. When the camera-subject distance is increased, allowance must be made for the decrease in intensity of illumination. This would mean a larger diaphragm opening, as it is not advisable to use an exposure longer than one-twentieth second when the camera is hand-held. Depth of field is greater at the longer camera-subject distances, so this should not suffer because of the larger aperture.

Cameras equipped with a behind-the-lens shutter can usually be fitted with a lens extension tube. A tube of the correct length will produce a close-up photograph of the optimum field size for intra-oral work. The writer has used this method successfully. A suitable telephoto lens will also produce excellent results, but probably no better for practical purposes than the front lenses.

Shutter speed and diaphragm opening.—The problem of exposure time and diaphragm opening was worked out to fit the requirements of this type of work and films available. Because of the short working distance, the maximum diaphragm opening which can be used is f. 12.7. If larger openings are used, depth of field will be lessened to the extent of throwing the molar teeth out of focus. The f. 12.7 opening makes one-twentieth second the correct exposure time. These settings are for Kodachrome Type A film. For Panatomic X or Finopan film the exposure is made at f. 18, one-twentieth second. Only fine-grain, and therefore relatively slow, black and white emulsions should be used.

Light source.—The source of light consists of four Mazda 3200° K, 500-watt bulbs, "A" shape. These bulbs are superior to photoflood or photoflash bulbs for color work for several reasons. The term, 3200° K, refers to the color temperature of the light source, and in these bulbs this remains constant, for practical purposes, throughout the life of the bulb (20 hours); 3200° K is the correct color temperature for Kodachrome Type A. Photoflood bulbs deteriorate rapidly because they employ an overloaded filament. This results in a rapid drop in color temperature after the first hour of their use. The life of these bulbs is 2 hours for the No. 1 and 6 hours for the No. 2 bulb. Heat production in photofloods is too great for close-range use in clinical work. The photoflash bulb has the shattering hazard, which makes it undesirable for use near the face. This is a remote danger, but, nevertheless, these bulbs do shatter now and then.

Reflector.—The reflector surface is the highly polished Alzak aluminum. This was developed especially for the lighting fixture industry and is not to be confused with ordinary polished aluminum. The difference lies in reflecting efficiency and resistance to tarnish or corrosion caused by heat from the light source or other causes. Substitute materials could be used, probably with good success. For instance, chromium-plated sheet metal, or ¼-inch plywood painted with heat-proof reflector paint would provide a workable reflecting surface. Slight changes in camera settings for exposure might be required.

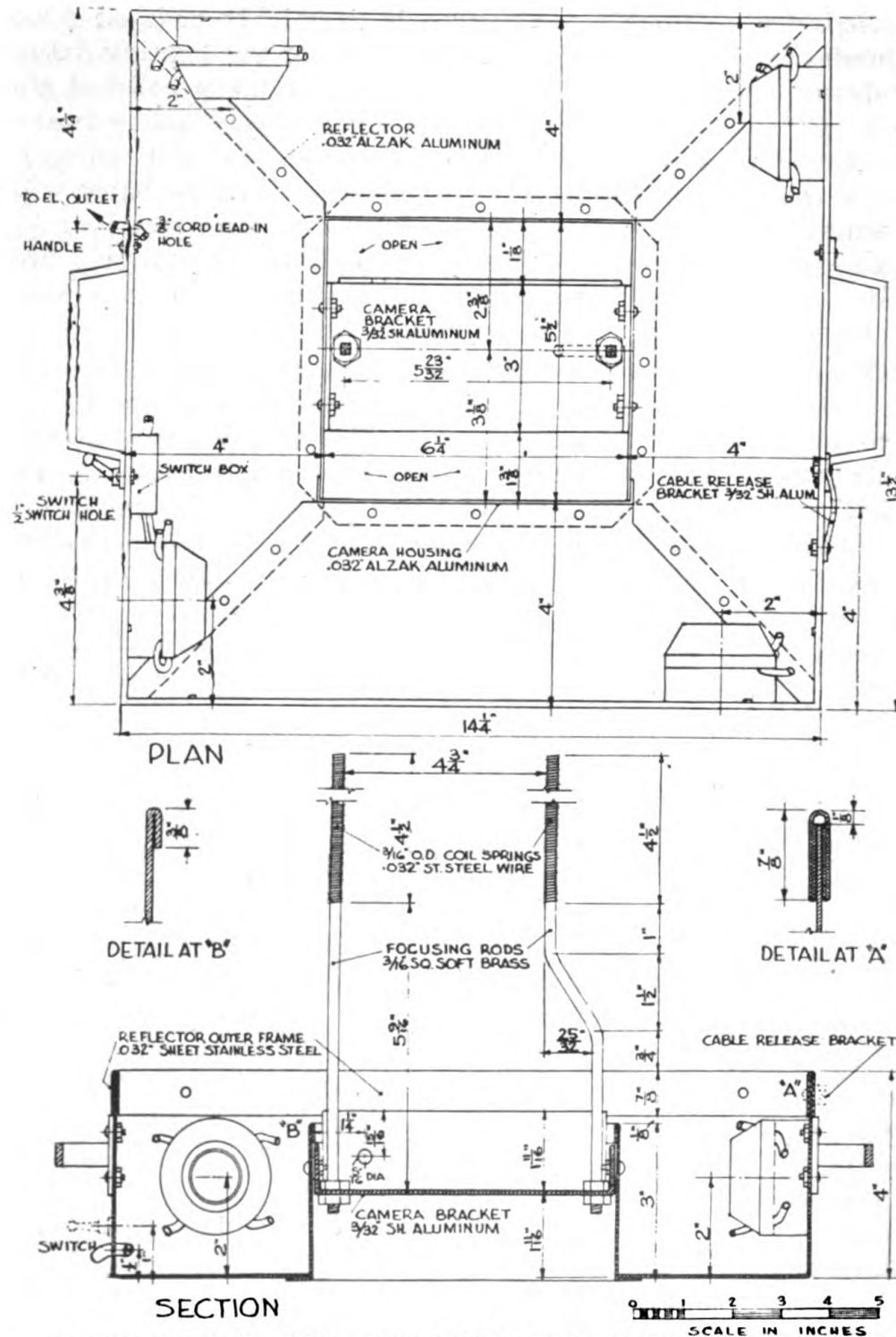
Focusing rods.—The purpose of the focusing rods is to facilitate quick determination of the camera-subject distance (which was previously worked out). The terminal 4½ inches of the focusing rods are made of coil spring to avoid bringing a rigid metal rod near the face, and to allow the coil spring portion of one rod to bend automatically out of the way when lateral views of the dental arch are being made. The buccal tissues, when retracted for a lateral view, present a bulge that would interfere with the positioning of the camera for such a picture if rigid rods were used. In taking this view, only the unbent rod is used to determine the focus and the field.

CONSTRUCTION

The details of the construction of the unit are shown in the accompanying layout. The reflector, camera housing, and camera bracket can easily be made by any good tinsmith. Aluminum or tinner's rivets are used for joining the parts of the reflector and housing. The rigid outer frame of the reflector is made of 0.032-inch sheet stainless steel, folded into four-ply strips and soldered or welded at each corner.

If the Argus C2 or C3 camera is used, the plans shown in figure 5 indicate the design and placement of the focusing rods, detail of the construction of the camera bracket, and the location of the camera relative to these parts. If another camera is to be used, these details can be worked out rather easily. If a larger camera is to be used, a proportional increase in almost every dimension of the unit should be anticipated, since the design shown here is very compact and would not allow for a larger camera.

Determining the camera-subject distance.—Because of the critical nature of close-up photography, it is advisable to determine the camera-subject distance for each individual camera and lens equipment. This is best done by the ground-glass focusing method. The following steps should be carefully followed.



CONSTRUCTION DETAIL OF REFLECTOR & CAMERA MOUNTING

Figure 5.

1. The diaphragm of the camera is set at the maximum opening.
2. The shutter is set on "time" and opened. The focus indicator is set at 3 feet.

3. The camera is opened and a piece of ground glass, slightly larger than 1 by $1\frac{1}{2}$ inches is placed in the focal plane, ground side of glass innermost, i.e., toward the lens, and held in place by means of Scotch tape.

4. The front lenses are installed.

5. The camera thus prepared is set on a table top, with a yardstick in line with the central axis of the lens and in *contact* with and projecting forward from the underside of the camera body.

6. A lamp is arranged so that the table in front of the camera is well illuminated. Other parts of the room should be relatively dark.

7. A card with some fine printed matter on it is moved slowly toward the camera, along and at right angles to the yardstick, while the operator is watching the ground glass for the image of the card.

8. The shortest distance from the card to the camera body at which the printing on the card is in sharp focus is determined and checked several times. This measurement (camera body to nearest point of sharp focus) is noted. The focusing rods are made to reproduce this distance in their relation to the camera body in the finished unit. For the Argus C2 or C3 this distance will be approximately $8\frac{1}{4}$ inches, which is approximately $6\frac{1}{2}$ inches from the front lens mount.

After the reflector, camera housing and camera bracket have been made by a tinsmith, the camera and focusing rods are mounted on the camera bracket. This should be done before the camera bracket is mounted in the camera housing, so that the relation of the focusing rods to the lens may be carefully measured and made to reproduce the camera-subject distance as determined previously. The length of the rods should be checked to make sure a subject at the distance they establish will be in sharp focus. This distance must be incorporated into the relation of the mounted camera to the mounted rods. Extreme care in this matter is very important. The rods should not appear in the field covered, and they should not be more than $\frac{1}{8}$ inch outside the field on each side. Thus the distance between the rod tips is $4\frac{3}{4}$ inches, the field being $4\frac{1}{2}$ inches in the long dimension.

SPECIFICATIONS FOR MATERIALS AND PARTS

Camera housing.—0.032-inch Alzak aluminum (lighting sheet).

Reflector.—0.032-inch Alzak aluminum (lighting sheet).

Reflector outer frame.—0.032-inch sheet stainless steel.

Camera bracket.—Sheet aluminum $\frac{3}{8}$ -inch thick.

Cable release bracket.—Sheet aluminum $\frac{3}{8}$ -inch thick.

Focusing rods.— $\frac{1}{8}$ -inch square soft brass rod.

- Coil spring terminal ends for focusing rods.*—Two 4½-inch lengths 0.032-inch stainless steel wire, outer diameter of coil ⅜-inch.
- Handles.*—Two chrome-plated or other suitable handles.
- Sockets.*—Four porcelain 2⅜-inch diameter with covered terminals and screw on upper portion, or similar plastic socket. Wired in parallel.
- Wiring beyond switch inside reflector.*—Twelve feet No. 14 slow-burning asbestos-covered wire.
- Plug.*—Heavy duty type with rubber housing.
- Lead-in cord.*—Ten feet No. 14 H.P.D. heater cord.
- Switch.*—No. 80206 H.&H. heavy duty appliance switch (toggle type).
- Switch insulation to cover binding posts.*—Electrician's rubber tape.
- Handle mounting.*—Eight ⅝-inch oval head, nickel-plated machine screws, ⅜-inch long, and hexagonal nuts.
- Camera bracket mounting.*—Four ⅜-inch round head, nickel-plated machine screws, ⅜-inch long, and hexagonal nuts.
- Socket mounting.*—Eight ⅝-inch round head, nickel-plated machine screws, ⅜-inch long, and hexagonal nuts.
- Coil spring-brass rod joint.*—End of rod rounded and inserted into core of coil ⅝-inch. Soldered joint.
- Cable release bracket mounting.*—Two ⅝-inch nickel-plated, oval head machine screws, ⅜-inch long, and hexagonal nuts.
- Focusing rod mounting.*—Four ¼ 20 (USS) jam nuts.
- Focusing rod threading for attachment to camera bracket.*—¼ 20 (USS).
- Cable release.*—Eight-inch length to fit camera.
- Camera mounting to camera bracket.*—Standard tripod screw.
- Bulbs.*—Four No. A25, 3200° K, 500 W (GE or Westinghouse).
- Front lenses.*—One each 2°+ and 3°+ Kodak Portra lenses, series V for Argus C2 or C3. Other sizes available for other cameras.
- Front lens mounting.*—Kodak adaptor ring, series V, No. 18 for Argus C2 or C3. Kodak retaining ring series V. Other sizes available for other cameras.
- Cheek retractors.*



SOAPS IN PROPHYLAXIS OF WOUND INFECTION

Soaps placed in actual contact with the uncontaminated fresh wounds produce a definite but slight irritation. This was noted only on microscopic examination; gross examination revealed no difference between control wounds and wounds into which soap had been placed. However, in wounds which were contaminated by placing a given amount of a culture of *Staphylococcus aureus* within their depths and then exposed to soap, there was a definite increase in signs of infection over those found in the control wounds not exposed to soap; "green" soap was found more irritating than "white" soap.—PETERSON, L. W.: Prophylaxis of wound infection; studies with particular reference to soaps and irrigation. Arch. Surg. 50: 177-183, April 1945

CLINICAL MASQUERADES OF MALARIA

OBSERVATIONS IN SOUTH PACIFIC COMBAT AREAS

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During the first 8 months of the Solomon Islands campaign, nearly all of the casualties, both medical and surgical, passed through an advance Naval base hospital set up at Espiritu Santos and its field stations at Guadalcanal and Tulagi. From September 1942 until April 1943, in addition to the patients admitted with a diagnosis of malaria, approximately an equal number who had malaria were admitted with other primary diagnoses. Many of these were surgical battle casualties and others had medical conditions such as acute infectious jaundice, dysentery, fungous infections of the skin, and dengue.

Authors who have studied any large series of malaria cases have been impressed with the marked diversity of symptoms presented by patients with this disease. The so-called textbook picture of clinical malaria may be distorted by many bizarre syndromes which can occur, and depending upon the predominating symptoms, mistaken diagnoses can readily be made. This is especially true in the field, where laboratory and other tests may be limited or unavailable.

It has therefore seemed interesting and profitable to study a group of missed cases of malaria and to examine more carefully a few of the more common masquerades of the disease as they were seen in the early days of the Solomons activity. A series of 100 patients who were originally admitted to the hospital with a diagnosis which subsequently was changed to malaria forms the basis of this report. Only those cases with a proved diagnosis of malaria have been included in this group, and these patients were selected because the disease was (apparently) the sole cause of the clinical picture at the time of admission.

In the accompanying table these 100 patients are divided into five major groups, classified according to the predominating symptoms which led to the diagnosis. Some comment is made about each group.

CONDITIONS DIAGNOSED AS DISEASES OF THE CHEST

A diagnosis of chest pathosis was made in 34 percent of the cases; this constitutes the largest single group of missed malarial cases.

*Admission diagnoses in 100 cases of missed malaria
(classified according to the diagnosis made upon the basis
of history, symptoms, and localized pain)*

Diseases of the chest:		34
A. Cardiac	21	
B. Pulmonary	13	
Diseases of the abdomen:		26
A. Stomach	9	
B. Liver and gallbladder	8	
C. Spleen	6	
D. Appendix	3	
Diseases of the bones and joints:		21
Diseases of the head:		12
A. Brain	7	
B. Eyes	3	
C. Other	2	
Miscellaneous:		7
A. Kidney	4	
B. Other	3	
Total		100

Of these, in 21 the symptoms were related to the heart and in 13 to the lungs and pleura.

Cardiac cases.—The cases diagnosed as cardiac disease included angina pectoris, coronary thrombosis, paroxysmal tachycardia, auricular fibrillation, extra systoles, and heart block. A case typical of the heart-pain group follows:

Case 1.—A Marine sergeant, age 34 years, was evacuated from a forward area by air because of a constant excruciating pain over the heart. The pain was so severe that 6 morphine Syrettes (grains 3) were given in the first 24 hours. With the pain appeared to be a certain degree of shock and there was a definite cyanosis of the mucous membranes. The pulse was rapid (108), regular, but of poor quality. Blood pressure varied from 90 to 104 mm. of Hg. systolic and from 54 to 60 mm. of Hg. diastolic. The heart sounds were distant and of poor quality; no murmurs were heard. Râles were present at the bases of both lungs. The patient was nauseated and vomited several times but this might have been due to the morphine.

A diagnosis of acute coronary thrombosis had been made on the field. An emergency electrocardiogram was made upon admission to the hospital and was found to be within normal limits. The leukocyte count was 9,200 with 78 percent segmented cells. The urine contained a trace of albumin; the sedimentation rate was eleven. X-ray examination of the heart and lungs showed them to be normal. The temperature was 100.6° F. and respirations 30 per minute. The patient was treated expectantly with sedatives.

About 10 hours after admission (36 hours after onset of the heart pain) the patient began to vomit and then had a violent chill with a temperature which climbed to 105.4° F. in the next 2 hours. A thick-blood smear showed many malarial parasites, and antimalarial treatment with quinine was started. The attack subsided at the end of 4 days with a clearing up of all of the previous cardiac symptoms. Repeated electrocardiograms showed no changes and there was no alteration in the white blood cell count.

This was the patient's first malarial episode; he had been in a malarious area for about 6 weeks and had been on suppressive atabrine therapy for 19 days. He was returned to active duty at the end of 3 weeks.

In this case, as in others of the cardiac group, the clinical picture on admission was predominantly one of acute heart disability, and the true pathosis was not suspected until the characteristic chill occurred and the positive smear for malaria parasites had been obtained.

In most of these patients the cardiovascular symptoms were promptly relieved by antimalarial therapy, although a few had residual complications with some unusual electrocardiographic tracings. This group of patients, together with a series of abnormal electrocardiographic records found in patients with diagnosed malaria, will be described in another report.

Two patients were admitted with a diagnosis of paroxysmal tachycardia and one with auricular fibrillation; in all three the abnormal rhythms disappeared after the malaria had been discovered and treated. There were 5 patients who had extrasystolic arrhythmias, with symptoms severe enough to demand immediate evacuation from the front for treatment; these cardiac conditions also proved to be due to malarial infection, and all the patients were returned to duty after the cause had been discovered and treated. Space does not permit a detailed presentation of the cardiac cases in this group; some of them have been discussed previously.¹

Pulmonary cases.—There were 13 patients in the group of missed malarial cases who were admitted with a diagnosis of lung or pleural disease; 8 of these were sent in for atypical or virus pneumonia, 4 for pleurisy, and one for possible lung abscess. The following case of atypical pneumonia is illustrative of this group.

Case 2.—A hospital apprentice, second class, age 20 years, complained of pain in the upper right part of the chest. The pain was worse on deep inspiration, and on the second day some blood-tinged sputum was raised after a paroxysm of coughing. When he reported to the sickbay he had a slight elevation of temperature (99.8° F.). On physical examination there appeared to be changes in the breath sounds over the area where the pain had started. No x-ray was available. The leukocyte count was 7,400 with 76 percent segmented cells. The following day the patient developed extremely severe, generalized pain over the right part of the chest, and many moist and crepitant râles were heard posteriorly.

On the afternoon of the fifth day he had a moderate chill with a temperature rise to 101.4° F., without apparent change in the general clinical picture, but 12 hours later he awoke with a violent chill which lasted about 40 minutes and was followed by a temperature of 105.2° Fahrenheit. An emergency thick-blood smear showed a heavy concentration of *Plasmodium vivax*. Following

¹ HYMAN, A. S.: Cardiovascular disease in tropics. U. S. Nav. M. Bull. 42: 545-559, March 1944.

routine treatment the lung condition promptly subsided, and a roentgenogram taken upon arrival of a hospital ship a week later showed no abnormalities.

One of the patients admitted with pleurisy had a slight cough with a low-grade temperature for about 10 days before the development of a sharp pain in the right lower part of the chest. Three x-ray examinations of the lungs yielded negative findings. Then the patient had a chill, and a smear proved positive for malaria.

Another admission diagnosis of pleurisy was made in the case of a young Marine officer who complained of severe pains in the left side of the chest posteriorly. The discomfort was worse on deep inspiration and his chest had been strapped twice with some relief. He had a chill about 2 hours after entering the hospital and a slight rise in temperature. Three blood smears were negative but a smear was found positive for vivax infection the following day. All of the pleuritic symptoms disappeared after the institution of anti-malarial therapy.

A middle-aged officer of a construction battalion was diagnosed as having a lung abscess because of a daily rise in temperature to 103° or 104° F., and because of findings in the right upper part of the chest. No x-ray facilities were available, but the leukocyte count was 12,500 with 85 percent segmented cells. The patient had a long history of a chronic cough, and 5 months previously had been admitted to a sickbay with acute bronchitis. This history, together with the clinical course of the disease, suggested the diagnosis of lung abscess. Accordingly sulfathiazole therapy was given in rather large doses, but with no appreciable change in the patient's symptoms.

At the end of the third day he had a severe chill, but the temperature did not rise above 103.6° Fahrenheit. He was nauseated and vomited several times. The possibility of a sulfonamide reaction was considered and the drug was stopped. He had another violent chill about 8 hours later followed by a third the next day, but none of the chills were accompanied by high fever. Repeated malarial smears after the first chill were negative, but finally one was obtained positive for *Plasmodium falciparum* in small concentration. After one week's intensive antimalarial treatment, the condition subsided and the signs in the chest disappeared.

This case was also interesting in that the temperature following the chills was never very high; this was in contrast to the usual thermal reactions observed in malaria patients being treated at this time.

CONDITIONS DIAGNOSED AS DISEASES OF THE ABDOMEN

About one-fourth (28 percent) of the patients in whom the diagnosis of malaria was missed were admitted to the sick list with

symptoms pointing to some abdominal disturbance. The common denominator in nearly every instance was abdominal pain, nausea, and vomiting; many patients also had diarrhea. These patients could be classified into four general groups, depending upon the predominating localized symptoms. Thus nine were listed as having a disease of the stomach, eight of the gallbladder or liver or both, six of the spleen, and three of the appendix.

Gastric diseases.—The common symptoms in these patients were related to an acute and subacute type of afebrile disturbance of the stomach; all of the patients complained of upper abdominal and epigastric cramps, sometimes with radiation to the back. Many had nausea and a few had recurring vomiting spells. There was usually considerable anorexia present and constipation was the rule. The following case is typical.

Case 3.—A yeoman, second class, age 25 years, was suddenly seized with upper abdominal distress while performing his regular work under combat conditions. There was no localizing pain, but a general heaviness and soreness over the epigastric region. At first the distress was relieved by food but seemed to become worse upon chewing gum or smoking. He received a few soda-mint tablets at the nearest first-aid station and most of the symptoms disappeared. On the following day the pain returned and was more severe. He became nauseated but did not vomit.

On examination the entire epigastric area was tender to palpation but there was no abdominal rigidity. There was no fever but the pulse rate was rapid (98 per minute). Alkali powders gave complete relief, but 2 days later all of the gastric symptoms returned despite continued use of the antacid.

The patient was then admitted with a diagnosis of acute gastritis, cause unknown, for further study and treatment. Before gastric examination could be completed, he complained that the pain was so sharp that he could not breathe, and a few minutes later he experienced a prolonged chill followed by a rise in temperature to 104.8° Fahrenheit. Thick-blood smears showed many malarial parasites, *Plasmodium vivax* in type, with about an 0.4 percent erythrocyte involvement. After antimalarial treatment all of the gastric symptoms subsided.

The follow-up on this man was interesting; he had three relapses of malaria in the next 11 weeks despite atabrine suppressive therapy. The onset of each attack was preceded by from 2 to 4 days of gastric symptoms and he learned to anticipate a malarial episode whenever he began to have trouble with his stomach.

In this group there were also three diagnoses of peptic ulcer and two of duodenal ulcer. These patients all had more or less characteristic histories. X-ray studies made on two patients yielded negative results; x-ray was not available for the others. Positive malarial smears were obtained in all following the diagnostic chill which occurred in from 2 to 5 days after admission to the hospital. Most of the ulcer symptoms disappeared during the course of anti-malarial treatment. Some of these patients had been on a suppres-

sive atabrine routine, but their gastric symptoms did not seem to differ from those who had not been on such therapy.

Liver and gallbladder diseases.—There were eight patients in this group; four had symptoms of acute liver lesions, three had rather typical gallbladder histories, and one had a complicated pancreas-gallbladder syndrome. The liver cases were interesting.

Case 4.—A machinist's mate, first class, age 31 years, had been on suppressive atabrine therapy for over 3 months; his skin was deeply pigmented with atabrine yellow. About a week before entering the hospital he noticed that his urine was very dark in color, but because a highly concentrated urine is common in the tropical combat areas, particularly after exposure to prolonged high temperatures, this finding was disregarded by the chief pharmacist's mate in charge of the field dispensary.

Three days before admission the patient became nauseated and later had several episodes of vomiting without nausea. He finally had complete loss of appetite, and on the day of admission, appeared to be semicomatose and was roused with difficulty. The temperature was 99.6° Fahrenheit.

The admission note stated that "the patient presents a picture of acute or subacute hepatic disease, possibly an atypical form of acute infectious jaundice. A mild epidemic of this latter disease has broken out in the area where the patient has been working. The skin is deeply jaundiced and the urine is scanty but strongly colored with bile. The liver is not palpable but it appears to be tender on palpation. The spleen, however, can be felt easily but it is not tender. Intravenous dextrose to combat liver toxicity as well as the dehydration which is probably present is recommended."

Following the intravenous administration of 1,000 cc. of 5-percent dextrose the patient had a violent chill with a rise in temperature to 105.4° Fahrenheit. An emergency blood smear showed many malarial parasites, *Plasmodium vivax* in type. In spite of vigorous antimalarial treatment, the patient had repeated daily chills and all blood smears were positive during the next 6 days. He then made an uneventful but rather protracted convalescence.

During his stay at the hospital many examinations were made of the urine, but bile was never found. The dark color in the beginning was due to a highly concentrated urine. It was the opinion of all observers that the pigmented skin was the combination of atabrine coloration and tanning by the sun, since the covered portions of the skin were more of a lemon-yellow shade. The patient had been wearing shorts and no shirt; the exposed parts did, however, on superficial examination appear to have a distinctly jaundiced coloration. In this case Cavanagh's observation that in doubtful cases the appearance of the scleras is of extreme importance in the differential diagnosis between atabrine pigmentation and jaundice was the decisive factor; this patient had no discoloration of the scleras.

In reviewing this case, the factors of prolonged exposure to the tropical sun, chronic dehydration with its symptoms of nausea, vomiting, and semistupor, together with the jaundice-like pigmentation of the skin from atabrine and sun tanning, and, finally, the mistaken assumption that the dark color of the urine was due to bile, led to the admission diagnosis of acute liver disease. Con-

sideration was also given to the fact that a mild epidemic of acute infectious jaundice was then sending many men to the hospital.

This same combination of symptoms and circumstances was repeated in several other cases in different degrees and was responsible for mistaken diagnoses of liver and gallbladder disease. Space does not permit presentation of these cases, but all had many interesting and sometimes obscure syndromes which subsequently were found to be malaria, usually benign tertian.

Splenic cases.—In retrospect the diagnosis in these cases should never perhaps have been mistaken, but these patients were admitted to the hospital during the very early days of the Solomons campaign and before most of the medical officers became "malaria conscious." It is doubtful that such errors will occur again under similar circumstances, but they are presented here as a matter of record. Four of these patients were admitted for trauma to the spleen, probably rupture, and two for splenic disease, cause unknown.

Case 5.—A chief water tender, age 38 years, was on a destroyer when a near-miss bomb threw the ship laterally. He was standing in a hatch and received most of the impact upon the part of the abdomen which was not covered by his life jacket. He had his breath knocked out, but recovered in a few moments and continued with his duty. About 6 hours later he began to have a dull ache in the left upper quadrant of the abdomen. This persisted all night and on the following morning he awoke with nausea. The pain was less but he felt very weak. A note on the health record stated ". . . the abdomen is stiff and there is marked spasm, particularly in the epigastrium. No free fluid can be demonstrated but from the patient's present condition rupture of the spleen is possible with peritoneal hemorrhage. Exploratory laparotomy is indicated."

It required about 6 hours to transfer the patient to the hospital; he was accompanied by a medical officer during the last 2 hours of the trip. The following note was made by the medical officer: "There can be no question now of a ruptured spleen. The trauma to the abdomen, the upper left quadrant pain and spasm, as well as the general appearance of the patient, all point to a surgical spleen."

Upon admission the hemoglobin was 92 percent, the erythrocyte count was 4,008,000 and the leukocyte count 6,500 with 65 percent segmented cells. A blood smear did not show any malarial parasites. Just as he was to be prepared for operation he had a long chill lasting about an hour and followed by a rise in temperature to 103.4° Fahrenheit.

The onset of the chill and fever caused some doubt about the diagnosis, and since there was no evidence of any great hemorrhage, it was decided to wait a few hours. This proved to be wise; a smear positive for malaria was finally obtained on the fourth trial. The patient was watched expectantly by the surgical service while antimalarial treatment was started. He subsequently had two more chills, and as time went on, the abdomen became relaxed enough to allow palpation of a rather large tender spleen. There was an uneventful recovery and the patient returned to duty in about 3 weeks.

This type of case emphasizes the important relationship between trauma of the abdomen, particularly of the spleen, and the lighting up of malaria in its suppressed or subclinical phase. Indeed experience has shown that trauma or shock of any kind, involving any part of the body, may be responsible for a malarial relapse. Several theories are offered to explain this phenomenon; the most acceptable has to do with the sympathetic system and its relation to shock-produced epinephrine. The adrenalin test for suspected malaria in patients with negative blood smears is largely based upon the reaction of the spleen in liberating parasites after injection of epinephrine. This test has been used here many times in doubtful cases with a fair percentage of positive smears after repeated negative results. Sometimes the mere palpation of a spleen during physical examination of a patient having suppressed malaria may be sufficient to precipitate a relapse; this occurs too frequently to be purely coincidental.

With these considerations in mind, it can be readily understood, therefore, that trauma to the abdomen, especially over or near the spleen, may be responsible for reactivation of a malarial infection, and that the set of circumstances attending the accident, together with the clinical picture, may all contribute toward a mistaken diagnosis of ruptured spleen. At the same time it must not be forgotten that abdominal trauma, if severe enough, *can* cause splenic injury and hemorrhage. During the campaign there were a number of such cases in patients who also had malaria. The picture, in these instances, however, is usually somewhat different. There is always evidence of blood loss with a falling erythrocyte count and drop in hemoglobin content, the shock is greater, the pulse is poor and feeble, and there is a falling blood pressure. All of these findings may also occur in a malarial attack but rarely to such a degree and completeness of picture.

Acute appendicitis.—Three patients who had malaria were admitted with a diagnosis of acute appendicitis; all presented the characteristic symptoms of abdominal pain, at first general and then localized to the right lower quadrant. Two were severely nauseated and were vomiting. All had been on suppressive atabrine therapy for various lengths of time. Emergency blood counts cast some doubt on the diagnosis in two instances; the leukocyte count was too low (5,500 and 6,200). While under expectant treatment both of these patients developed chills and fever, and blood smears subsequently obtained were positive for malarial parasites. The other case is interesting:

Case 6.—A private, first class, age 22 years, while on outpost duty had been hit by a small fragment from a personnel bomb dropped during an enemy

raid. The injury was a minor one, involving the left shoulder. He had received a first-aid dressing and remained at his station. During the night he awoke with a severe chill and vomited several times. With a rise in temperature he began to have abdominal cramps and unsuccessfully tried to move his bowels. The pains grew worse and finally became well localized in the lower right quadrant of the abdomen.

A note made by the medical watch stated: "Abdomen very stiff and rigid, especially over appendix region. As pain in belly has increased, the fever has fallen to 100.4° Fahrenheit. Believe patient has malaria but that he also has had acute appendicitis. Should be evacuated for operation as soon as possible . . ."

The patient was flown back to the base hospital where he arrived about 8 hours later. His temperature was normal but he looked sick. Physical examination showed an atabrine-pigmented young man, markedly dehydrated, sweating, nauseated, and complaining of a dull pain over the right lower quadrant of the abdomen. The hemoglobin content was 78 percent, the erythrocyte count was 4,200,000 and the leukocyte count 11,200, with 88 percent segmented cells. The urine was normal but concentrated; specific gravity was 1.038. A blood smear was found positive for *Plasmodium vivax*; there was approximately 0.2 percent erythrocyte involvement.

The patient had malaria but did he also have acute appendicitis? The consensus was that a laparotomy should be done but that the operation might be delayed pending further observation. He was given saline and dextrose infusions together with quinine. He had a moderate chill that night with a rise in temperature to 104.2° Fahrenheit. The pain grew worse, the abdomen was again rigid and the patient again began to vomit.

It was then decided that nothing would be gained by waiting any longer, and the abdomen was opened; the appendix was quickly mobilized and found to be somewhat inflamed but perhaps no more so than the adjoining cecum and colon. In fact many of the loops of bowel showed the same type of capillary injection. The spleen was visualized and seemed to have many subcapsular hemorrhages. The surface of the liver appeared to be normal. There was a little free fluid; cultures from this later proved it to be sterile. The appendix was removed and the wound closed without drainage.

Pathologic examination of the appendix showed a serosal inflammatory process with a minimal round cell infiltration. Special staining failed to show any malarial parasites but a smear made from the abdominal fluid prior to culture showed a number of these parasites.

The patient had considerable ileus for the first 48 hours, and 2 chills with a moderate rise in temperature. Following this he made an uneventful recovery. He was evacuated to a base hospital in New Zealand, where the atabrine suppressive treatment was stopped. He had another malarial episode in about 3 weeks, this time also with abdominal pain but of much less severity.

In reviewing the most common symptoms of malaria as seen in the South Pacific area, those relating to the abdomen ranked equally high in frequency with those of the central nervous system and those of the bones and joints. Abdominal pain, cramps, nausea, vomiting, and diarrhea were seen in most cases in some degree. It is little wonder, therefore, that when these symptoms predominated in the clinical picture, a mistaken diagnosis could be made

and the malarial background could be overlooked. As the medical officers became more familiar with the vagaries of the disease, fewer patients were admitted with a diagnosis of abdominal disease.

CASES DIAGNOSED AS BONE OR JOINT DISEASE

As indicated previously, pain and disability of the skeletal system is a common symptom in the early phases of malaria. Sometimes this pain is extremely severe and occasionally the bone, joint, and muscle pains are the only somatic complaints during the attack. Patients who had several relapses would often state that they could anticipate an attack because a certain bone or joint, or a combination of bones and joints, would become painful. Often these symptoms would precede the chill by as much as 48 hours. Diagnostic blood smears made during this "prodromal period" were, however, usually negative. In several instances an attempt was made to stop or abort the relapse by giving large doses of atabrine during this period, but this appeared to have no effect and the chill usually appeared on schedule.

With the original clinical complaints so closely related to the skeletal system, it is not surprising that there were 21 missed cases of malaria in this group. Of these, 8 involved the spine and back, 7 the shoulders and arms, and 6 the hips and legs. In general, the picture was one of acute arthritis, but in one patient a diagnosis of acute osteomyelitis of the lower tibia was made. A case illustrative of the general group is presented:

Case 7.—A seaman, second class, age 26 years, was evacuated from a minesweeper because of pain and disability of the right shoulder and back. He misled the hospital corpsman on board by saying that he had had rheumatism and arthritis several years before. He was seized with severe pain in the shoulder joint while climbing down a ladder. At first he thought that he had wrenched his arm but later decided that he had some pain previously. The pain grew worse and was described as knife-like. In the beginning, it seemed to be only in the shoulder joint but in a few hours the whole shoulder was involved and there was so much spasm of the muscles that movement of the arm was considerably restricted.

Movement of the arm did not seem to increase the pain but the patient held the joint semiflexed. In the next few hours, the pain spread to the neck and upper back and the patient complained that he could not move his head.

He was admitted to the hospital about 8 hours after the onset, with a diagnosis of arthritis, acute, of the right shoulder and cervical spine. He was placed on routine treatment with salicylates, sedatives for the pain, oil of wintergreen to the painful parts, and bed rest. The patient's temperature was normal. The following morning, x-ray films of the shoulder joint and cervical spine showed no evidence of abnormality. The hemoglobin content was 76 percent, the erythrocyte count was 3,940,000, and the leukocyte count 6,600 with 56 percent segmented cells. The urine was normal. Blood smears did not show any malarial parasites.

Late that afternoon, about 32 hours after the start of the pain, the patient had a chilly sensation, felt nauseated, and vomited several times. The salicylates given were blamed and acetylsalicylic acid was substituted; there was no rise in temperature and no change in the local symptoms. On the following afternoon at exactly the same time, the patient had a violent chill which lasted about 40 minutes, followed by a fever of 105° Fahrenheit. Three blood smears were taken before one positive for malarial parasites was obtained 6 hours later.

Under intensive antimalarial therapy the painful joints cleared up, but the patient said that he had a certain amount of stiffness in the shoulder for several weeks thereafter. This was the patient's primary attack of vivax malaria. He had not been on suppressive treatment. He had two subsequent relapses, each one preceded by a similar arthritic syndrome.

One patient in this group was admitted with a diagnosis of acute rheumatic fever; he had polyarticular pain and a low-grade fever for 3 days. A systolic mitral murmur seemed to complete the picture. He had, however, a low white blood cell count (6,400) and a low sedimentation rate (8 mm. in 1 hour) and the electrocardiogram was normal. He was given salicylates and quickly became nauseated. He then had a chill with a moderate rise in temperature. The third blood smear taken showed the presence of *Plasmodium vivax*.

The diagnosis of acute osteomyelitis of the lower tibia was made in one instance. The patient was admitted with a rather characteristic history of a sharply localized pain about 2 inches above the inner malleolus. The area was considerably reddened, but this might have been due to the vigorous application of various liniments and rubbing compounds which had been used for the relief of the pain. For 5 days prior to admission the patient had been having a spiked temperature; once to 103.6° and twice to 101.8° Fahrenheit. This occurred every afternoon about 1630; neither the pulse nor respiratory rates were correspondingly increased.

The hemoglobin content was 82 percent, the erythrocyte count 3,860,000, and the leukocyte count 9,400, with 64 percent segmented cells. The urine was normal. Blood culture yielded negative results, and there were no findings upon x-ray examination of the leg.

The patient had been on rather large doses of sulfonamides and the urine was beginning to show crystals. Repeated blood smears were negative for the malarial parasite. On the second day of admission, the patient began to complain of a vague pain in the left upper quadrant of the abdomen. In the opinion of several examiners no spleen could be palpated, but on the following morning the lower edge of the spleen was distinctly felt. That afternoon he had a severe chill and subsequent blood smears contained many *Plasmodium vivax* parasites.

As suggested previously, it is possible that manipulation of the spleen by the several examiners may have precipitated the release of the parasites into the blood stream. This patient had been on intermittent atabrine suppressive therapy and he denied any prior malarial episodes. Following antimalarial treatment the leg symptoms promptly disappeared.

Although dengue is popularly known as "breakbone fever" because of the severe bone and joint pains suffered during the course of the disease, especially as it was seen in the South Pacific epidemic of 1942 and 1943,² many patients with malaria had equally severe symptoms involving the bones and joints. Indeed many patients who had suffered both diseases complained more of these symptoms during their malarial bout than when they were passing through the dengue infection. In both conditions, however, the skeletal symptomatology is frequently severe enough to make a differential diagnosis from acute arthritis difficult and at times, perhaps, impossible.

CASES DIAGNOSED AS DISEASES OF THE HEAD

In the group of 100 missed cases of malaria, 12 patients were admitted to the hospital with diagnoses relating to pathosis of the head and its structures; of these, 7 related to the brain, 3 to the eyes, 1 to the sinuses, and 1 to the mastoid. With headache as a common symptom in certain types of malaria, this may be the outstanding complaint in unsuspected cases.

The headache in malaria occurs in many degrees of severity; in some there is only a fullness or sense of dullness but in many the pain may be very great. The entire head may be equally involved or the pain may be localized to a single point or area. Undue weight may be given to the pain as a factor in diagnosis. It is thus not difficult to understand how a sinusitis or a mastoiditis might be suspected when the predominating pain symptoms pointed to these parts of the head.

More difficult for differential diagnosis, however, are those cases of malaria with actual brain and cord involvement. In the seven cases of brain pathosis mentioned, five patients were admitted with a diagnosis of possible meningitis. The following case is typical of this group.

Case 8.—A hospital apprentice, second class, age 21 years, had for 3 days prior to admission been on more or less continuous battle station watch. He complained of a generalized headache and some nausea but thought that it might have been due to the inhalation of smoke fumes. The headache became

²HYMAN, A. S.: Heart in dengue; some observations made among Navy and Marine combat units in South Pacific. War Med. 4: 497-501, November 1943.

worse and he then noticed a stiffness of his neck; his temperature was 100.4° Fahrenheit. On the afternoon of the second day he had a fainting spell with twitching of the left arm and leg and he vomited several times, but he made a quick recovery and insisted on continuing with his duty. About midnight he fell asleep and could not be roused for some time; his head was described as being held in a peculiar position and it could not be straightened out by the hospital corpsman.

The ship was a considerable distance from its base, but a diagnosis of possible meningitis was made via communications by the medical guard, as there was no medical officer on board. The patient was given routine doses of sulfathiazole and on the following day he was evacuated to an advance medical station and immediately flown to the hospital. On admission he presented a rather complete picture of acute meningitis. The temperature was 105° F., he was unconscious, and nuchal rigidity and reflex changes were present.

Diagnostic spinal puncture yielded blood-stained fluid under considerable pressure. No organisms were found on smear, but a few malarial parasites were seen in the erythrocytes. A thick-blood smear was, however, strongly positive for *Plasmodium vivax*; there was about 0.3 percent red blood cell involvement. Other laboratory data showed a hemoglobin concentration of 76 percent, an erythrocyte count of 3,540,000, and a leukocyte count of 11,200 with 68 percent segmented cells. The urine showed 2-plus albumin. Roentgenograms of the chest showed only a diffuse hilar clouding on both sides. On subsequent culture of the spinal fluid it was found to be sterile.

Intensive intravenous treatment with quinine was given and after a stormy 24-hour period the patient made a fairly normal recovery, although on suppressive atabrine routine he had two relapses in the next 4 months.

Cerebral malaria in various degrees of severity was not uncommon in the early days of the South Pacific campaign. The diagnosis was not difficult in most instances, as the condition developed during a malarial episode and usually followed other symptoms of the disease. When, however, the cerebral manifestations came first, a differential diagnosis from epidemic meningitis had to be made, and in cases developing in the field where little or no laboratory study was possible the problem was at times a difficult one.

Clinically the two diseases have much in common and without an examination of the spinal fluid, a diagnostic blood smear for malaria, and a white blood cell count, it is doubtful that a positive diagnosis can be made. Even a history of previous malarial infection may be deceiving. In one case, for example, the patient was just convalescing from the fourth relapse while on atabrine routine when he developed a severe headache, high temperature, and a stiff neck. Spinal tap showed a pus-streaked fluid with many intracellular diplococci.

Meningococcus meningitis occurred in minor epidemic form in all of the services in the South Pacific area during July to December 1942; its development and the fact that meningitis was also

seen in sporadic instances had much to do, perhaps, with the other mistaken diagnoses of cerebral malaria in this series.

CASES DIAGNOSED AS DISEASES OF THE EYES

Severe pain localized in one or the other orbit was seen in three patients. In this group all were admitted with a diagnosis of probable infection of the eyeball. Some swelling was present over the affected side of the face and some degree of photophobia was present in all. The fundus was normal in most instances and x-ray films of the skull and sinuses showed no evidence of abnormality. The institution of quinine therapy, after blood smear showed malarial parasites, usually cleared the local condition in the eye within a few days.

These cases were not remarkable and are of interest only because the predominant symptoms of the malarial episode were related to the eyeball and were the first subjective manifestations of the disease; the diagnostic chill and positive smear occurred 2 or 3 days after the local symptoms.

In this group one patient was admitted with a diagnosis of sinusitis and another with mastoiditis; both of these proved to have malaria and all symptoms disappeared during quinine treatment.

MISCELLANEOUS MISTAKEN DIAGNOSES

In this final group 4 patients were admitted with a diagnosis of kidney disease, 2 with thyroid disease, and 1 with scrotal disease. One patient in the renal group presented an interesting problem.

Case 9.—A boatswain's mate, second class, age 27 years, was a member of a submarine diving crew and at times worked under water with a small diving helmet when repairing various parts of the gear. However he rarely went more than a few feet below the surface in this work. On the day before admission, he complained of a dull aching pain in the left flank. It was worse while he was under water, and he felt chilly although the day was very hot and the water was warm. He experienced pain on voiding and the urine was dark brown.

In the evening the pain in the left lumbar region became worse and he vomited several times and had many chilly sensations. His evacuation to the hospital was delayed several hours by an alert, and when he arrived he presented a picture of acute renal colic.

The temperature was normal and a white blood cell count showed 7,500 leukocytes with 54 percent segmented cells.

The entire left flank was tender and rigid. He was unable to void and difficulty was encountered in catheterization. A small amount of dark urine obtained was found to contain a few erythrocytes and many crystals, and had a high specific gravity (1.036). It was considered that this was consistent with the dehydration type of nephrolithiasis so common in the tropics, and the patient was admitted to the genito-urinary service for further treatment.

X-ray examination on the following morning showed shadows suggestive of several small stones in both kidney pelves. The patient was still complaining of pain in the left lumbar region and he had a slight temperature (99.6° F.). The urine continued to be scanty.

He was given abundant fluids and during the day the specific gravity of the urine fell from 1.032 to 1.012 but the pain persisted. An emergency cystoscopy was started but as the instrument was being passed, the patient had a violent chill and the instrument had to be removed. The chill lasted about 30 minutes. Repeated blood smears were negative for malarial parasites.

In the patient's past history there was a vague story about sensitivity to procaine and to epinephrine. With no clinical evidence of malaria, it was decided that the chill may have been due to instrumentation.

Bloody urine was obtained from both kidneys; the hematuria persisted for several days. On the afternoon of the fourth day, the pain localized in the left kidney region, and the patient had another chill which was much less intense than the previous ones. Blood smears remained negative, but 2 hours later, while making a routine thin smear for a differential white blood cell count, a few malarial parasites were discovered. Intravenous quinine was started after the possibility of blackwater fever was largely ruled out, and there was a remarkable response in the patient's symptoms. All pain disappeared within the next 8 hours.

This case, like the three others in the renal group, presented interesting diagnostic problems, especially when hematuria was a part of the clinical picture. Although the incidence of blackwater fever in the South Pacific area during 1942 and 1943 was extremely low (from 0.02 to 0.05 percent in various reported series), whenever blood appeared in the urine of a patient being treated for malaria with quinine, the possibility of the condition was perhaps overemphasized.

COMMENT

A series of 100 mistaken admission diagnoses of various conditions which subsequently were found to be malaria have been presented. These diagnoses were all made during the early days of the Solomons campaign before most of the medical officers attached to the various combat units were familiar with some of the bizarre manifestations of South Pacific malaria.

In retrospect it would seem that many of the missed cases of malaria should have been suspected from the very onset of the patient's symptoms; as the number of malarial cases increased and as the protean characteristics of the disease became better known, the number of mistaken and missed cases decreased markedly. In our experience there are a certain number of patients with malarial infections which continue to defy detection; there are even a larger number in whom the disease can only be suspected but never proved by positive blood smears.

Following the first great mass hospitalization for malaria in

September to December of 1942, the pendulum of medical expediency swung, perhaps, too far in the direction of making the diagnosis on every patient who did not feel quite well for one reason or another and when no other diagnosis was obvious. During January and February of 1943 the hospital was filled with combat personnel admitted with suspected malaria; most of these were promptly returned to duty after a short course of antimalarial therapy. Many had negative blood smear findings; some only had fever of unknown cause. The therapeutic response to quinine or atabrine was perhaps one of the most important of the various criteria employed in making a diagnosis.

The problem became somewhat more complicated in the latter part of this period by an outbreak of dengue which reached its peak in March. Most textbooks describe malaria and dengue as two distinct clinical syndromes readily differentiated. This was not the experience here, since the two diseases have much in common, especially in the early phases of the infection. Doubtless there were many missed cases of malaria treated in the dengue group and vice versa. These statements are made in the attempt to picture the background and environmental factors which may have influenced the medical officer in many of these missed malarial cases; it also underscores some of the difficulties experienced in practicing medicine in the combat areas.

In reviewing the missed cases, the common denominator in all has been the overemphasis placed upon the predominant localizing symptoms and the pain related to these symptoms or referred to the part suspected of being involved in some pathologic process. This was especially true in the cardiac, pulmonary, gastro-intestinal, articular, and brain cases; when the true evaluation was subsequently given to these manifestations of malaria, the entire syndrome was more clearly understood.

Malaria is primarily a hematogenous disease; regardless of the mode or site of the original introduction of the parasite, it is not until a blood-stream infection develops that the basic pattern of chills and fever occurs. With the circulation invaded, the organisms are carried to every part of the body. Experiments have shown that the parasites may be unequally distributed in the various tissues and organs of the host; when they accumulate in great concentrations, the part involved tends to respond in its own characteristic manner. The parasites apparently are productive of thrombogenic substances, which in the smaller arterioles and capillaries may cause more or less complete occlusion, or acute inflammatory changes.

In organs such as the brain, heart, and kidney, these parasitic

occlusions may well be responsible for symptom-complexes familiar under other etiologic processes leading to similar pathologic changes; occlusions of minor coronary branches by malarial thromboses, for example, will not differ materially in clinical manifestations from occlusion due to atheromatosis. Infarction of the kidney presents the same basic pattern whether it is caused by malarial occlusion or any other condition which interrupts blood flow. It is thus not difficult to understand that a kidney filled with malarial parasites will present a picture of renal pathosis, or that a myocardium invaded by these organisms will give the patient heart symptoms.

The parasites are also apparently responsible for various degrees of inflammatory changes of serous membranes; the peritoneum, pleura, pericardium, synovia, meninges—all may react in a specific manner and produce symptoms characteristic of the tissues involved. This is probably the explanation of the many bizarre symptoms seen in certain cases of malaria and it also gives a rationale to the mistaken and missed cases.

Finally a word about the response of these symptoms to anti-malarial drugs—quinine, atabrine, and to a lesser extent to plasmochin. In most instances the patient was relieved within the first 48 hours; occasionally the painful symptoms persisted for a week or longer. In some cases the specific effect was dramatic. When the usual types of sedation for the relief of pain were of little value, quinine, especially by the intravenous route, acted promptly. One may well speculate on its mode of action; by analogy to the sulfonamides and their action on streptococci, it is possible that quinine and atabrine render the parasites incapable of producing the toxic substances responsible for the local inflammatory reactions which lead to the various painful symptoms.

SUMMARY

From a large group of malaria cases seen during the first 8 months of the South Pacific campaign, a series of 100 missed cases has been studied. These patients had been admitted to the hospital under other diagnoses. The most common masquerades of malaria have been mistaken for diseases of the heart, lungs, gastro-intestinal tract, bones and joints, head, and kidney. Typical case histories have been presented, and an explanation of the factors responsible for these mistaken diagnoses has been given.

NEUROPSYCHIATRIC MANIFESTATIONS IN MALARIA

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The experience of most medical officers who treated malaria patients in the South Pacific was that pronounced neurologic or psychiatric manifestations were not common, but that when they did occur they were to be considered among the most dramatic and urgent of medical emergencies. The neuropsychiatric symptomatology in this disease has received comparatively little attention, as it is usually overshadowed by the better known somatic symptoms.

There is no classic clinical picture of cerebral malaria, but the occurrence of neurologic signs or psychiatric symptoms, or an alteration in the patient's behavior or personality, together with a malarial background, should indicate damage to the nervous system. The term cerebral malaria is applied usually to subtertian malaria in which the cerebrum is affected and cerebral symptoms appear. However any part of the central or peripheral nervous system may be involved in the course of malaria, either of the benign or malignant type.

During a period of 21 months in the South Pacific area the writer had occasion to observe many cases of malaria. Statistics regarding the incidence of neuropsychiatric complications in malaria, based on the demonstration of parasites rather than on clinical evidence, are not always a true indication of the extent of such complications. Some investigators believe that there is too great a tendency to blame malaria for many of these symptoms in the absence of demonstrable parasites, and chiefly because a diagnosis of malaria, rightly or wrongly, has once been made.

In considering laboratory reports of blood smears, it must be realized that a single or even several negative reports are insufficient to exclude malarial infection. On the other hand the detection of a single true malarial parasite is adequate to make a diagnosis of malaria, but would not necessarily account for the patient's symptoms or signs.

When the red blood cells become parasitized they develop the property of "stickiness," having a tendency to coalesce and adhere to the walls of the blood vessels containing them. Parasitic localizations in the brain are supposed to be due to thrombotic and

embolic occlusions of capillaries and arterioles. Because of these vascular disturbances, widespread toxic and necrotizing lesions may develop. These include the so-called ring hemorrhages of the brain, the perivascular areas of necrosis, and the degenerative changes in the cells of the nerve tissues. The degree of damage is proportionate to the extent of the plugging of the smaller cerebral vessels. Malaria as a particular type of infectious process follows the characteristic pattern of any disseminative type of infection.

The symptoms vary greatly in intensity and duration. They depend on the severity of the infection, the location of the lesion, the extent of the infarction produced, and the age of the patient. Motor irritative symptoms are less frequent than degenerative symptoms. In general these patients may be classified symptomatologically as (1) those presenting meningitis with slight focal or generalized neurologic signs; (2) those exhibiting definite localizing signs, as apoplectic phenomena (hemiplegia or aphasia) and including coma, sometimes with convulsions; and (3) those showing signs in the spinal cord and peripheral nerves.

In one base hospital there were seven patients with cerebral malaria, three of whom died. Death occurred within a few hours despite immediate intravenous administration of quinine. One patient had been admitted in coma with the history of having had an epileptic attack; the second patient also had generalized seizures associated with unconsciousness, and the third merely had generalized tremors and mild tetany, but without loss of consciousness.

As a result of focal sporulation aphasic, bulbar, hemiplegic, epileptiform, and other clinical types of cerebral malaria may be encountered. Severe persistent frontal or supra-orbital headache, which did not respond to the ordinary analgesics, was a common complaint in those suffering from recurrent attacks of malaria. Occasionally an elevation of the spinal fluid pressure is found by manometric measurement, and the removal of from 10 to 15 cc. of spinal fluid gives some relief to the patient. Some loss of memory is not uncommon after severe or repeated attacks of malaria. Neuritis of the optic, abducens, facial, ulnar and peroneal nerves may occur, as well as paresis of the soft palate and vocal cords. Brachial plexus neuritis has also been noted. In one case, a patient who had anisocoria, a slow rhythmic, alternating dilatation and constriction of one pupil was noted. This disappeared spontaneously.

Paraplegias due to spinal cord involvement have been observed, as have also paresthesias, anesthetics and neuralgias. Involvement of the spinal nerves may be manifested by diminished tactile, pain and temperature senses, reduction or abolition of the deep

tendon reflexes, tenderness over the peripheral nerves, paresthesias, and wrist or foot drop. Polyneuritis in the course of malaria has also been described, but its cause is open to question, for latent beriberi, which may have been activated by the malaria, must be considered.

When the brain is heavily infected with *Plasmodium falciparum* or *vivax* the patient may be drowsy, but is easily roused to answer questions or obey simple commands. His answers will often be irrational and the speech slurred. Movements will be largely purposeless, but no definite paralysis may be evident. Untreated, the coma deepens and the patient becomes completely paralyzed before death. In the less severe cases, and with prompt appropriate treatment, the patient slowly emerges from coma and is convalescent within a week.

When the heat-regulating center is affected, the patient develops a hyperpyrexia, the temperature rising to from 104° to 107° F., usually associated with severe headache and with delirium. While the temperature is rising the patient develops slow clonic movements of the limbs followed by tonic contractions. The neck muscles become stiff, the hands are firmly clenched, the body may assume the attitude of opisthotonos and the patient lapses into coma. After an indefinite period relaxation occurs and consciousness returns. This sequence may be repeated an indefinite number of times, sometimes in rapid succession, until death occurs unless treatment is prompt, energetic, and efficient.

A common clinical picture is that of an apparently healthy person, perhaps with a slight frontal headache, who suddenly falls down unconscious. No localizing paralysis is found, but there may be complete flaccid paralysis of all four extremities. A blood smear may contain ring forms of *P. falciparum* or may be negative. With treatment the patient may emerge from his coma within from 24 to 48 hours and be symptomless within a week. In other cases, quite similar clinically, the patients do not respond to treatment with quinine. After partially recovering from the effects of embolic cerebral malaria, a second embolism may occur in spite of quinine therapy. The outlook then becomes grave, but is not necessarily fatal.

Psychiatric manifestations.—The psychiatric manifestations may be grouped as personality changes, expressions of the patient's experience of the disease; as psychotic symptoms perhaps directly referable to the location of the cerebrovascular thromboses; and as a known, generally recognizable disease entity such as schizophrenia or manic depressive psychosis. In many cases transient attacks of depression were noted which may be merely an evidence

of the patient's general emotional instability. The mood varied readily, but a few patients were constantly dull and apathetic and some were irritable and restless.

In general the psychic symptoms were consistent with the mental make-up of the patient but may have been activated by the disease. Every sick person experiences his illness in a manner which is in accordance with his personality make-up. A patient, recognizing that his disease may become chronic, may react with resignation or anxiety, depression or resentment. The rapidity of improvement, and profound alteration in the affective field, following the administration of antimalarial therapy in some of these psychoneurotic and psychotic patients, suggested a toxic rather than a psychopathologic basis for the symptoms. Malarial psychoses are usually primarily of the confusional type but may be transformed into more protracted forms.

In some patients who gave histories of frequent recurrent malarial attacks, intellectual, attentive, memory and emotional disorders were noted, occurring in various combinations and evidenced by slowness of thought, lack of power of concentration, failure of memory, apathy, and indifference. Usually these intellectual disorders were minimal.

Less frequently malaria patients were noted with great distortion of thought and oddities of conduct simulating schizophrenia. Occasionally a patient was observed to be suspicious and paranoid, while others were silly, smiling and giggling without apparent cause. Persecutory and grandiose delusions, sometimes of a bizarre type, as well as auditory and visual hallucinations, were also noted. The hallucinations and ideas of reference may represent unadjusted aspects of the personality which have been projected because of the disturbance at the organic level.

It is reasonable to suppose that the secondary symptoms, such as depressed and paranoid states, depend to a considerable extent upon the mental make-up of the patient before he contracted malaria. However there seems no need to assume that malaria plays any different role from other organic diseases which may also be followed by psychoses.

Differential diagnosis.—The variety of symptoms which may be produced often makes diagnosis difficult. In fact the diagnosis may remain in doubt until there is favorable response to quinine, or until it is established by postmortem examination. The only certain diagnosis can be made upon finding malarial parasites in the peripheral blood. Cerebral malaria must be distinguished from meningitis, epilepsy, alcoholic poisoning, heat stroke, typhoid, cerebral hemorrhage or thrombosis, uremia, and diabetic coma.

Meningococcal or pneumococcal meningitis may simulate cerebral malaria.

Lumbar puncture is essential in all doubtful cases, especially as the plasmodia may be found in a patient who is also suffering from meningitis. The spinal fluid in cerebral malaria is usually clear and within normal limits of pressure and cell content. With meningeal irritation there is likely to be a moderate pleocytosis. The fluid, however, is sterile on smear and culture.

Treatment.—Treatment must be directed toward combating the infection and the associated symptoms. Oral treatment with quinine or atabrine is often difficult, besides being slow in its action. Therefore intravenous or intramuscular routes are preferable. The treatment of choice is combined intravenous and intramuscular injections of quinine supplemented by epinephrine. An intravenous injection of quinine dihydrochloride, grains 10 in 10 cc. of distilled water or normal saline, is followed by 1 cc. of epinephrine intramuscularly or subcutaneously. An additional 20 grains of quinine is given in two doses by injection into the gluteal muscles during the day.

A very satisfactory method is to give the quinine simultaneously with an intravenous infusion of saline. After the intravenous saline is started, 10 grains of quinine dissolved in 10 cc. of water is injected into the rubber tubing attached to the saline cannula. This technic minimizes the trouble of a separate injection with risk of shock. It may not be necessary to repeat the intravenous medication, but so long as there is mental dullness or inability to swallow, intramuscular injections should be continued. As soon as the patient is able to swallow he should be given quinine orally and treatment should be continued until a total of 200 grains has been given. The daily dose should not exceed 30 grains. On the completion of the course it is advisable to give 2 days' treatment with plasmochin. The bowels should be kept open with soapsuds or glycerin enemas.

For cases associated with hyperpyrexia, hydrotherapy (cold water douching, sponges, ice bag to the head) is often effective. The heart should be watched and epinephrine, strychnine or digitalis given when necessary. For those patients with maniacal behavior or violent delirium, sedation with bromides, nembutal or sodium amytal is very helpful.

SUMMARY

Malarial infection of the central or peripheral nervous system may simulate many well recognized organic and functional conditions and diseases. The neural involvement shows great variability and may range from cranial to peripheral nerve impairment.

Although the mental symptoms are not usually prominent, they may be of wide variety.

Malaria as a cause of temporary mental disturbance, or as a causative or precipitating agent in mental diseases, presupposes a previous finding of malarial parasites in the peripheral blood, or a history of recent recurrent attacks of malaria. It is acknowledged that patients suffering from malaria may manifest psychic symptoms which antedated the disease, and that they may also have a superimposed psychoneurosis or a functional psychosis. The rapid response and improvement in the mental symptoms with antimalarial therapy would indicate a direct causal relationship in many cases.

Routine psychiatric examinations and a keener cognizance of the possibility of concomitant psychologic alteration may disclose more cases and lead to a better understanding of this problem.



EPINEPHRINE IN THE TREATMENT OF MALARIA

Outside Italy little is known of the use of epinephrine in the treatment of malaria as advocated by Professor M. Ascoli, head of the Clinica Medical of Palermo University. It is easily administered intravenously, is harmless and it can be given to ambulant cases. The action on the spleen is immediate and dramatic. The treatment is based on three facts: (1) The spleen contains the reserve supply of red blood cells; (2) the spleen is a contractile organ, and by contracting floods the general circulation with red cells whenever there is a call for additional oxygen, as in asphyxia, diminished atmospheric pressure (high altitudes, etc.), emotional states, fatigue, etc; (3) the stimulus is supplied by the medullary hormone of the suprarenal glands.

It is an established fact that the natural protective power of the blood plasma is able to deal with large numbers of parasites circulating freely in the blood stream. It is claimed by many workers in this field, in addition to Professor Ascoli, that, if the spleen is emptied daily for, say, 30 days, there is no need for any other form of treatment. Quinine is given only when there is a rise in temperature, and then only in comparatively small doses. However combined operations, using epinephrine to drive the parasites out into the open and quinine at the same time administered orally, subcutaneously, or intravenously to aid in the destruction of the freed parasites, would appear to be the common-sense method of attack on malaria.—MACDONALD, D. C.: Adrenaline in the treatment of malaria. *Brit. M. J.* 1: 567-568, April 21, 1945.

PSYCHIATRIC PREPARATIONS FOR COMBAT IN A MARINE DIVISION

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Lieutenant Commander (MC) U.S.N.R.

The psychiatric measures undertaken in preparation for combat, in a Marine Corps division during its last months of training in the final staging area, are most important. The objectives sought in the work done in the early months of this year on a tropical island just south of the equator in the Southwest Pacific were: (1) The elimination of the psychiatric unfit; (2) the promotion of mental health; (3) the inauguration of preventive psychiatric measures in actual combat; and (4) the preparation for the care of psychiatric casualties in the field.

Elimination of the psychiatric unfit.—Though the screening of the psychiatric unfit is chiefly the responsibility of psychiatric units in induction stations, recruit training camps, and other advance training centers, a number of cases are first detected in the final staging area. In the final month of training, 38 patients had to be hospitalized for medical survey. Of these it is considered that 14 could have been detected earlier in their training, 20 were incapacitated because of psychiatric illness connected with combat or with other service conditions, and 4 developed a psychiatric disorder unassociated though coincident with service life. Brief histories of typical cases follow.

CASE REPORTS

Case 1.—A 23-year-old Marine was referred for psychiatric consultation because of his frequent disciplinary offenses, often associated with his apparent inability to understand orders given to him. He had been unable to learn in school, but had been pushed along to the seventh grade because of his size. Several times in civilian life he was jailed for such offenses as extreme profanity or flying into uncontrollable rages. On examination he was found to have an I. Q. in the moron range, and decided psychopathic tendencies.

Other cases that could have been detected earlier in training include 6 schizophrenics, 3 epileptics, 1 feeble-minded, a psychosis unclassified, a psychoneurotic, and a homosexual.

Case 2.—A 20-year-old Marine was referred because of a variety of neurotic complaints which did not respond to symptomatic treatment. He had been overseas 28 months, having seen action at Tarawa and Saipan. His

symptoms began following his last campaign and increased in severity as further combat became imminent. His past history was irrelevant. He had completed the tenth grade in school, and had worked successfully as a machinist's apprentice. He was considered suffering from operational fatigue.

There were 19 other cases similar to case 2.

Case 3.—A 21-year-old Marine was referred by his commanding officer following a letter received from his wife expressing concern regarding his mental condition. His letters had become strange and incoherent. The past history was unrevealing. He had served satisfactorily in two combat operations. The family history revealed that his mother was confined in a state mental institution. On examination the patient was clearly psychotic, with blunted affect, distortion of thought processes, ideas of unworthiness, and auditory hallucinations. A diagnosis of schizophrenia was made.

Among the other cases unrelated to service conditions were another schizophrenic, an acute manic, and a man with migraine. In addition to the 38 patients who were hospitalized, 23 others were seen in the same period and were returned to duty after treatment. Most of these had mild neurotic symptoms associated with prolonged overseas duty. In the subsequent combat operation, none of these became psychiatric casualties.

Promotion of mental health.—After consultation with the commanding general, who was most cordial and cooperative, it was decided that a direct mental hygiene approach to the enlisted men in their final stage of training would be unwise, because of the danger of being more disturbing and provocative than helpful. It was thought, however, that a series of talks on psychiatric subjects would be most useful for the officers. These consequently were given to groups in the various regiments of the division.

The talks were brief, lasting about 20 minutes. They stressed the military importance of psychiatric casualties, both in reduction of total strength and in effect on the morale of the remaining men. A parallel was drawn between mental health and physical health. It was pointed out that physical health was more than the absence of disease, that it was a positive matter involving the development of robust musculature, endurance, resistance to infection, and, in military life, particular immunity toward those physical diseases prevalent in the various war theaters, such as tetanus, typhoid, typhus, cholera, yellow fever, smallpox, and plague.

Similarly mental health comprises such positive elements as alertness, resourcefulness, high spirits and morale, courage, and particular immunity toward the chief psychiatric disorder of war, "combat fatigue." In the production of mental health in troops the following topics were discussed: Good leadership, with the recognition of the enlisted man as an individual; thorough train-

ing, resulting in self-confidence (the antidote to fear) under all battle situations; strategic orientation, knowledge of what we are fighting for; tactical orientation, understanding of the purpose and importance of the particular military mission; morale measures, including the full utilization of recreation officers, chaplains, and Red Cross representatives.

Preventive psychiatric measures in actual combat.—Officers were impressed with the importance of a proper attitude toward the man who is a psychiatric casualty in battle. Such a man is not to be considered a moral weakling, since any man, including the officers themselves, may be the victim if he is sufficiently exposed to the causative factors. The chief causative factors discussed were: Extreme and prolonged physical fatigue, lack of proper food, lack of water, insufficient sleep, exposure to cold and wet, and the psychologic effects of acute danger to oneself with the sight of others killed and maimed.

It was recognized that all of these are often unavoidable in a military operation. The purely military demands and exigencies must come first despite cost in men. Particularly is this true in the traditional Marine policy of aggressiveness and rapid attack. A quick win, notwithstanding casualties, may well save lives in the end. But in assessing the cost, officers must not lose sight of, or underestimate, the potential losses inherent in exposing men for too long a period to the catastrophic forces of war. Emphasis was placed on the value of more frequent rotation of men in the front lines, of providing as far as possible the elementary comforts of life, of rewards for the foot-slogging infantryman, and during rest periods, of the few luxury elements that are available even in the field. In this last connection the full utilization of the Red Cross field representatives was urged. It was added that at times, when such a thing is possible, it is a tremendous morale booster to let men know when their period of ordeal is scheduled to end.

It was admitted that despite all efforts, some psychiatric casualties are inevitable. The importance of recognizing these cases as early as one recognizes physical casualties was emphasized, since immediate treatment is just as urgent in the one case as in the other. A comparison was drawn between the fighter and the familiar truck tire. Each can be retreaded if steps are taken before the wear is too great. But once the wear is allowed to go through the vital fabric, there is a "blowout" and each is through. In mild cases officers may take matters into their own hands and provide the necessary rest and rehabilitation. In more serious cases, however, the aid of the medical officer should be sought.

A word was added regarding officers themselves. Though they are undoubtedly more stable as a group than the enlisted men, they are human and have their breaking point. Since defection or loss of an officer is far more serious from a military point of view than that of an enlisted man, it is all the more important for officers to recognize the early symptoms of combat fatigue in themselves and obtain proper care. The chief early symptoms were mentioned (unusual fatigability, loss of appetite, insomnia, battle dreams, irritability, emotional instability, increased startle reaction, inability to concentrate, absentmindedness, and general inefficiency). It was stressed that all of these are but exaggerations of the normal, and that many of us have some of these symptoms from time to time without the necessity for considering ourselves abnormal.

Preparations for the care of psychiatric casualties.—Medical officers in the division were indoctrinated in the psychiatric theory regarding the aforementioned causes of combat fatigue. Plans were made for the treatment of patients as near the front as possible. Patients with symptoms could be kept overnight in the battalion or regimental aid stations, given mild sedation and reassurance, and urged back to duty the next day. The more severely affected would be treated in the division field hospital.

Arrangements were made for the establishment of a psychiatric ward, preferably at some distance from the surgical wards. Special supplies in the way of sedatives in quantity, and materials for restraint were obtained, not without some little difficulty. A group of hospital corpsmen was selected, using the criteria of educational attainment and agreeable personality, and those chosen were trained in the theory and practice of psychiatric nursing. The interest of these men was stimulated by lectures and reading material. The services of the chaplains were enlisted through personal contacts, so that the morale value of religious observance could be utilized to the fullest. A talk was given to the group of Red Cross field directors assigned to the division, and one man was especially designated to serve the patients in the psychiatric ward. All these men proved keenly interested in the problems of the psychiatric casualty and many suggestions were forthcoming regarding ways of boosting the morale of the patients through personal attention and the provision of recreational and comfort items.

TREATMENT OF TROPICAL SKIN DISEASES IN THE SOUTH PACIFIC

AN OUTLINE

ROBERT R. M. McLAUGHLIN
Lieutenant Commander (MC) U.S.N.R.

No medical officer in the field or on independent duty can avoid the necessity of treating skin diseases. On many ships the bulk of the daily sick call concerns these cases. Of about 2,000 hospital admissions and an estimated 3,000 consultations, during approximately a 9-month period, one-third of the patients with skin lesions came in with a diagnosis of fungous infection; 10 percent with ulcers, skin, legs; 10 percent with dermatitis venenata (tropical woods or foliage); 15 percent with pustular or cystic acne; and about 6 percent with impetigo or ecthyma. These five conditions accounted for more than 75 percent of the admissions.

The treatments which were found satisfactory in the management of all these skin conditions used materials readily available in all Naval medical activities.

FUNGOUS INFECTION OF FEET

LARGE BLEBS.

These are clear, multilocular, intensely pruritic blebs, occurring on the balls of the feet or the instep, singly or in irregular patches.

Treatment.—1. Trim off the tops of the blebs.

2. Dry and paint with 10-percent silver nitrate solution.

3. Dress with sal-sulfur ointment.

EARLY ACUTE INTERDIGITAL INFECTIONS.

The ordinary "athlete's foot" usually begins in the two lateral interdigital spaces, as pruritic, macerated or dry fissured lesions. Vesiculation tends to occur early. The eruption spreads by continuity to the sole of the foot and to the dorsal triangle based at the toes. Once established, the process is encouraged by excessive heat, mild trauma from ill-fitting shoes, much walking, and too irritating treatment. These factors may likewise activate a dormant or mild case. Infection of the shoes occurs at the earliest stages of the disease.

Treatment.—1. Touch open fissures and areas with 10-percent silver nitrate solution.

2. Apply a wet dressing of boric acid solution to edematous and swollen feet during the day.
3. Dress with sal-sulfur ointment at night.

SUBACUTE INFECTIONS.

The acute redness and soreness disappears in this stage, and the lesions are marked by the progressing undermining edges of rather dry patches with vesicular borders. On the dorsa of the feet, typical tinea circinata, especially on the areas covered by the field shoe, may occur.

- Treatment.*—1. Apply 10-percent silver nitrate and rub it into the border of each lesion with the cotton stick applicator. All vesicles must be ruptured.
2. Dress with sal-sulfur ointment.

CHRONIC INFECTIONS.

This stage is marked by dry eczematous changes at the site of previous acute eruptions. If weeping is present and severe, it is probable that the current medication is too strong, or that the patient has developed a local sensitivity to it. This may occur with relatively mild remedies, such as boric acid, in which case saline wet dressing or a plain talcum powder dressing will change the picture. If itching is severe and redness is pronounced, an acquired shoe leather sensitivity should be suspected. In any case, patch testing and bland treatments are indicated. In truly lichenified cases, however, 1-percent coal tar in Lassar's paste and stronger sal-sulfur ointments are often curative. X-ray therapy is particularly helpful in chronic cases, but is too often not available. Thirty-minute soaks in saline, tap water, or boric acid solutions, preceding the application of the stronger ointments, give increased effectiveness.

FUNGOUS INFECTION OF SKIN, CRURAL AND BODY AREAS

Tinea circinata is frequently encountered in the tropics and spreads with astonishing rapidity. The waist and crural areas are the most common sites, but no area is exempt from infection. The lesions are marked by the presence of red, ringed areas showing central healing and peripheral extension. Certain strains of organisms produce round patches without the usual central clearing. The active rim shows minute vesicles and sometimes actual bleb formation in the explosive types of the eruption.

- Treatment.*—1. Apply any reliable fungicidal solution, such as 10-percent silver nitrate, iodine-camphor, iodine compound solution, or 5- to 10-percent salicylic acid in alcohol each morning.
2. Cover with calamine lotion with 2-percent phenol.

3. Rub in sal-sulfur ointment each night.
4. Treatment of shoes is extremely important in order to prevent relapses by reinfection. Wash the inside of the shoes with soap and water, rinse well, and dry in direct sunlight.

Formulary of fungicidal preparations.—The following prescriptions have been employed successfully:

Sal-sulfur ointment—3-percent salicylic acid, 5-percent sulfur in 10-percent wax, 25-percent lanolin and petrolatum.

Stronger sal-sulfur ointment—6-percent salicylic acid, 10-percent sulfur in the above ointment base.

Iodine-camphor solution—20-percent tincture of iodine in spirits of camphor.

Iodine compound solution—iodine crystals 2 gm., potassium iodide, 2.5 gm., salicylic acid 2.5 gm., boric acid 5 gm. and 70-percent alcohol sufficient to make 100 cc. (Strickler's lotion modified).

Foot powder—salicylic acid 2 gm., boric acid 10 gm., magnesium carbonate 10 gm., talcum sufficient to make 100 grams.

ACNE VULGARIS, PUSTULOSA, AND CYSTICA

This eruption is a functional disorder of the sebaceous glands of the skin. It is definitely not an infection.

Contrary to popular belief, pustular and cystic acne eruptions are aggravated by tropical duty, and the condition frequently develops in men who have been free of the eruption during their adolescent years. If it has been present earlier in life it is almost certainly going to be aggravated by tropical duty. The constant and exclusive use of chlorinated drinking water, excessive sweating with associated stimulation of the oil glands of the skin, high temperatures and excessive humidity, the relatively high fat diet of the white man, and difficulties in maintaining personal hygiene under field conditions probably all contribute to the production and aggravation of the disorder. Eskimos eat a great deal of fat, but appear to utilize it and do not develop acne. How much influence psychosomatic factors and endocrine imbalance play in the causation of acne is undetermined.

The eruption first affects the skin of the face, nape of the neck, the central upper portion of the chest, shoulders, back, and upper arms. Occasionally the eruption also is found on the forearms, buttocks, thighs, and legs, particularly in so-called oil acne and other industrial types of the conditions. The fact that the eruption is often sharply terminated at the belt line suggests that sunlight is not good treatment for pustular and cystic acne, contrary to popular belief.

The specific lesions of acne vulgaris are papules and blackheads or comedones; those of acne pustulosa are similar with the addition of inflammatory pustules; those of acne cystica demonstrate both forms along with definite cysts of the "blind boil" variety, and sinus tracts (acne conglobata). The pustular and cystic forms are always followed by severe disfiguring scars. Secondary infection of acne can and does occur, but is rare. The inflammatory character of the eruption is primarily due to the "foreign body effect" of the retained sebaceous material in the pustules and cysts. The process subsides when the blackheads, pustules, and cysts are carefully and thoroughly evacuated.

The local and internal use of sulfonamides, in uncomplicated acne of any variety, is not only unjustified by clinical experience, but may do a great deal of harm in the tropics, and can only be heartily condemned. Their use indicates a basic misconception of the acne process. Penicillin has proved harmless, but disappointing and ineffective.

- Treatment*—1. Low fat diet—avoiding chocolate, nuts, peanut butter, greasy and fatty foods, pastry, carbonated drinks, excessive quantities of milk, cheese and butter.
2. A soapy shower at least once a day.
 3. Remove blackheads. Incise and drain fluctuant cysts and pustules. Apply wet dressings as needed.
 4. Apply 30-percent sulfur in calamine lotion twice daily.
 5. Avoid excessive sun bathing, sweating, exhaustion, constipation, and dirty, greasy clothes.
 6. Prompt evacuation of patients with severe cases to temperate climates—the most effective measure known for the control of this condition.

ULCER—IMPETIGO CONTAGIOSA—ECTHYMA

These infections are caused by the same organisms and are frequently concurrent conditions, if not various stages of the same condition. The lesions frequently begin as infected insect bites or trivial scratches, or follow other minor injuries that usually heal promptly in the temperate climates with little or no treatment. The infection progresses through the impetiginous and ecthymatous types of skin infections to form deep ulcerations, penetrating through the entire skin to underlying fascia and muscle.

Cultures of the ulcers show certain organisms so regularly that it is often possible to make a clinical diagnosis of the type of

organisms from the physical findings. Anaerobic nonhemolytic *Staphylococcus aureus* and *albus* produce a clear-cut ulcer without surrounding redness, but with a thick, tenacious, dark crust centrally adhering to the base. Hemolytic staphylococci produce a typical zone of hemolysis around the ulcer, the exudate is watery, and there is little tendency to crust formation. Diphtheroid organisms produce a whitish-yellow adherent thin membranous crust, free at the edges, and only a slight peripheral redness. True diphtheria of the skin does occur. In the rainy season particularly, and in improperly treated cases, a wide area around the ulcer may show "infectious eczematoid dermatitis" due to secondary local contiguous contamination and autoinoculation.

Ulcers following injuries are usually single, whereas those following insect bites are usually multiple and occur on both legs.

Treatment.—1. Culture should be taken if possible.

2. Apply saline wet dressings for from 24 to 48 hours, with the patient off duty, and until acute symptoms subside.

3. Cleanse and dry the ulcer, apply 10-percent silver nitrate solution.

4. Fill the ulcer with 10-percent ammoniated mercury ointment. Cover with sterile gauze.

5. Apply elastic bandage.

The prolonged use of sulfonamide powders and the internal administration of sulfonamides is not justified by experience or by the laboratory findings in most cases. Penicillin therapy is effective, but is a hospital procedure and the results have been no better than with the above regimen.

DERMATITIS VENENATA

The usual causes for the severe forms of this condition as seen in this area are the "rengas" trees, shrubs and vines, all of which contain a milky sap. The trees are of two general groups, those with a reddish wood and those with a pale yellowish wood. One of the latter variety also contains a substance which stains skin and clothing a jet black, but only in spots, as though two primary irritants were present. The wood will retain its irritating property, and furniture made from it has to be discarded.

The sap of the papaya tree is milky and harmful. The eruption appears anywhere from a few hours to several days after exposure, apparently depending on the degree of contact, and the susceptibility of the person. A history of sensitivity to poison ivy or oak may or may not be elicited. The eruption is characteristically pruritic, bright pink and vesicular. Linear vesicular lesions are only occasionally found.

- Treatment.*—1. Soapy shower, or if available, starch and soda baths should be taken twice daily. Salt water bathing is excellent therapy.
2. Apply boric acid wet dressings to all weeping areas.
 3. Apply calamine lotion with 2-percent phenol to all other areas, as often as necessary to control itching.
 4. As the eruption subsides, apply cold cream, boric acid ointment, or shaving cream.
 5. Give sedatives as needed.
 6. Allow 10 to 14 days for the eruption to subside.

MILIARIA RUBRA

This eruption is extremely common in the tropics. It is probably due to physiologic exhaustion of the sweat glands, with subsequent inflammation of the follicles. It occurs on skin areas not usually subjected to excessive sweating.

The characteristic eruption is a fine, pink, granular rash consisting of conical papules. It is accompanied by a typical, sharp, prickling sensation, sometimes occurring in apparently unaffected areas. The sides of the neck, the lateral surfaces of the trunk, the lower abdomen, crural and scapular regions, and the upper arms on the lateral surfaces, are frequently affected. In severe cases the entire trunk, arms, thighs and legs are involved. Chronic cases show a loss of the redness found in the acute lesions, and show a whitish, miliary lichenified and eczematized follicular eruption.

The rash appears on the tanned and untanned skin with equal frequency. A tolerance develops with most people after acclimatization is reached. If sunlight produces a profuse sweating, it must be avoided. However a brisk sunburn, sufficient to cause a mild exfoliation, often relieves the condition. Rest and the avoidance of severe sweating will always cause a subsidence of the acute case within a week or ten days. The ingestion of salt, calcium, vitamins and numerous other suggested remedies has proved of doubtful value and not warranted by experience.

- Treatment.*—1. Apply any antipruritic lotion such as: (a) Calamine lotion with phenol 1- to 2-percent; (b) alum 1-percent, menthol 0.25-percent in 70-percent alcohol; (c) alum 1-percent, menthol 0.25-percent, iodine 1.5-percent, camphor 2-percent in 70-percent alcohol.
2. For chronic cases apply from 3- to 6-percent

resorcin, 5- to 10-percent sulfur in calamine lotion, twice daily. Sal-sulfur ointment at bedtime may be useful in eczematized cases. Give sedation if needed.

IMPETIGO BULLOSA TROPICA

This term is used to indicate an extremely common and often persistent bullous impetigo, or "infected heat rash," seen in the tropics. It is characterized by the development of a few or numerous, superficial 0.5- to 1-cm. sized blebs, filled with a cloudy serum. These blebs are easily wiped off, leaving a pink, sharply defined, round, shallow erosion of the epidermis. Scarring never occurs, and crusting is slight. The axillary, crural, and gluteal areas are most commonly affected, but no skin areas are exempt.

- Treatment.*—1. Wipe off the blebs and apply tincture of mercuriolate, or 5- or 10-percent silver nitrate solution.
2. When dry, dust with talc.
 3. If severely infected anoint the general area with 5- or 10-percent ammoniated mercury ointment. Protect clothing with gauze pads.
 4. In persistent and recurrent cases the use of bichloride of mercury, 1:5,000 solution, after treating the blebs, is often curative.

SCABIES

Scabies is characterized by the presence of vesiculopapules, most abundant on the genitalia, flexor surfaces of the wrists, and between the fingers. Itching is worse from sweating, and at night. If personal hygiene is good, the eruption is relatively mild and may escape diagnosis for many months. If personal hygiene is poor, secondary urticaria, impetigo, furuncles, and severe scratch marks are usually present. The presence of this infestation, caused by the scabies mite, is commonly overlooked, but should be considered whenever a persistent, pruritic eruption is seen on the genitalia, wrists and finger webs, particularly in military personnel.

- Treatment.*—1. Soapy shower. While still wet apply benzyl benzoate lotion to the entire body except the face and scalp. Allow to dry and re-apply in 15 minutes.
2. Repeat soapy shower in from 6 to 12 hours. Change to clean clothes.
 3. Apply calamine lotion with phenol for subsequent itching. Do not repeat treatment for one

week, and then only if symptoms persist.

Benzyl benzoate lotion—benzyl benzoate 25-percent, liniment of soft soap 35-percent, and (95 percent) alcohol 40-percent.

MULTIPLE FURUNCLES

The common boil usually becomes multiple when there is excessive sweating and personal hygiene is poor. This staphylococcic infection is often difficult to control under field conditions. The use of vaccines is not practical, and is generally not required.

- Treatment.*—1. Use any local dressing, followed by 10-percent ammoniated mercury ointment.
2. Apply sal-sulfur ointment to entire body, with extra gauze dressings over draining lesions, for from 5 to 10 days.
3. Administer sulfonamides for systemic, severe infections.

PEDICULOSIS PUBIS

This condition is common, and is readily diagnosed by the presence of adult lice and of nits on the pubic hairs. In hairy persons the thighs and buttocks are also frequently infested.

Treatment.—Spray thoroughly with Freon Aerosol Insecticide.

DYSIDROSIS

This term is used to include pompholyx, dermatophytid and vesicular eruptions of the fingers, palms, soles and toes, occurring under conditions of excessive sweating. It is characterized by the development of small, deep-seated discrete vesicles, frequently along the lateral surfaces and the distal portions of the dorsal surface of the fingers. Itching is spasmodic and sometimes severe. Secondary eczematization occurs when the vesicles coalesce and rupture. True dermatophytid eruptions usually occur on the palms as well as the fingers. Fungous infection of the hands may cause dermatophytid eruptions on the soles and toes.

Contact eruptions, fungous infection and bacterial eczematoid eruptions are clinically distinct entities and must be considered in the differential diagnosis.

- Treatment.*—1. Apply 30-minute soaks, twice daily, of boric acid solution.
2. Dry well, and apply 2-percent salicylic acid in Lassar's paste:

URTICARIA

Urticaria is relatively uncommon in the tropics, because most men with known allergic manifestations rarely reach this area. The most frequent cause is the ingestion of excessive amounts of

fruit juices to allay thirst. Barbiturates and aspirin are the commonest drugs at fault, and insecticide sprays account for a few cases. Sulfonamides usually cause other forms of eruptions. A careful case history is worth more than any treatment.

- Treatment.*—1. Discontinue causative factor if known.
2. Apply calamine lotion with 2-percent phenol.
 3. Give sodium phosphate, 25-percent solution, or other mild laxative.
 4. Give sedation as needed. Avoid barbiturates if previously ingested.
 5. Epinephrine in oil (0.2 gm. to 1 cc.), or 5 to 7 minims of 1:1,000 aqueous solution may be given by injection for respiratory difficulty, but should be avoided if possible.
 6. Urticaria diet—eat only cooked fruits or vegetables, beef, lamb, chicken, milk, bread, butter, vanilla ice cream, simple puddings, tea and coffee (only one cup or glass per meal).

PITYRIASIS VERSICOLOR

This tineal infection is insidious and difficult to eradicate, but is not disabling. The infected areas show a mottled, finely scaling, large macular type of eruption. On tanned skins, the infected areas are whitish, but on untanned skin they have a typical “café au lait” color. The scaling is often difficult to see when the skin is moist from sweating. The sides of the neck, shoulders and upper trunk are usually first affected, but the eruption may become generalized and even affect the face.

- Treatment.*—1. Apply 5-percent calcium hypochlorite solution twice daily, or
2. Tar and mercury scalp lotion, each evening, after a shower. The following prescription may be employed: Bichloride of mercury 0.1, salicylic acid 0.5, castor oil 2, liquor carbonis detergens 6, and alcohol (95 percent) with distilled water, equal parts to make 100.

CLINICAL NOTES

TRAUMATIC SEGMENTAL EVENTRATION OF THE DIAPHRAGM

JOHN B. HARTZELL

Lieutenant Commander (MC) U.S.N.R.

The case to be reported here is of interest because of the deformity of the left diaphragm which was discovered after the patient had jumped 70 feet from the deck of a burning aircraft carrier, striking his abdomen on the surface of the sea. A surgical repair was performed, and at operation the deformity appeared to be a segmental eventration rather than a true hernia. Although there is no record of what the diaphragm had been like prior to his entry into the service, all of his symptoms dated from the injury; therefore the deformity is believed to have resulted from the trauma to the abdomen.

Case report.—The patient, 26 years of age, suffered a wound of the right foot and a fracture of the second and third metatarsal bones from a bomb fragment on 4 June 1942, during the Battle of Midway. He later jumped from the flight deck into the sea and remembers falling forward and striking his abdomen on the surface of the water. Following that, his next remembrance is regaining consciousness aboard a rescue ship and experiencing acute pain in the upper left quadrant of the abdomen and in the epigastrium, requiring morphine for relief. He vomited small amounts of food and fluid each time he tried to eat or drink.

Four days later he was admitted to a shore hospital where he remained 2 months. His foot was treated, and because of the persistent abdominal symptoms, roentgenographs of the gastro-intestinal tract were taken, which showed the diaphragm high on the left side, and diverticula of the duodenum. Medical management gave no relief. The distress following ingestion of food and fluids continued and the patient was transferred to the mainland.

On admission to this hospital, he complained of upper abdominal pain and bloating 1 hour after eating, and of regurgitation of small amounts of fluid after drinking. X-ray and fluoroscopic studies revealed the left side of the diaphragm to be high. It appeared to move slightly on respiration (fig. 1).

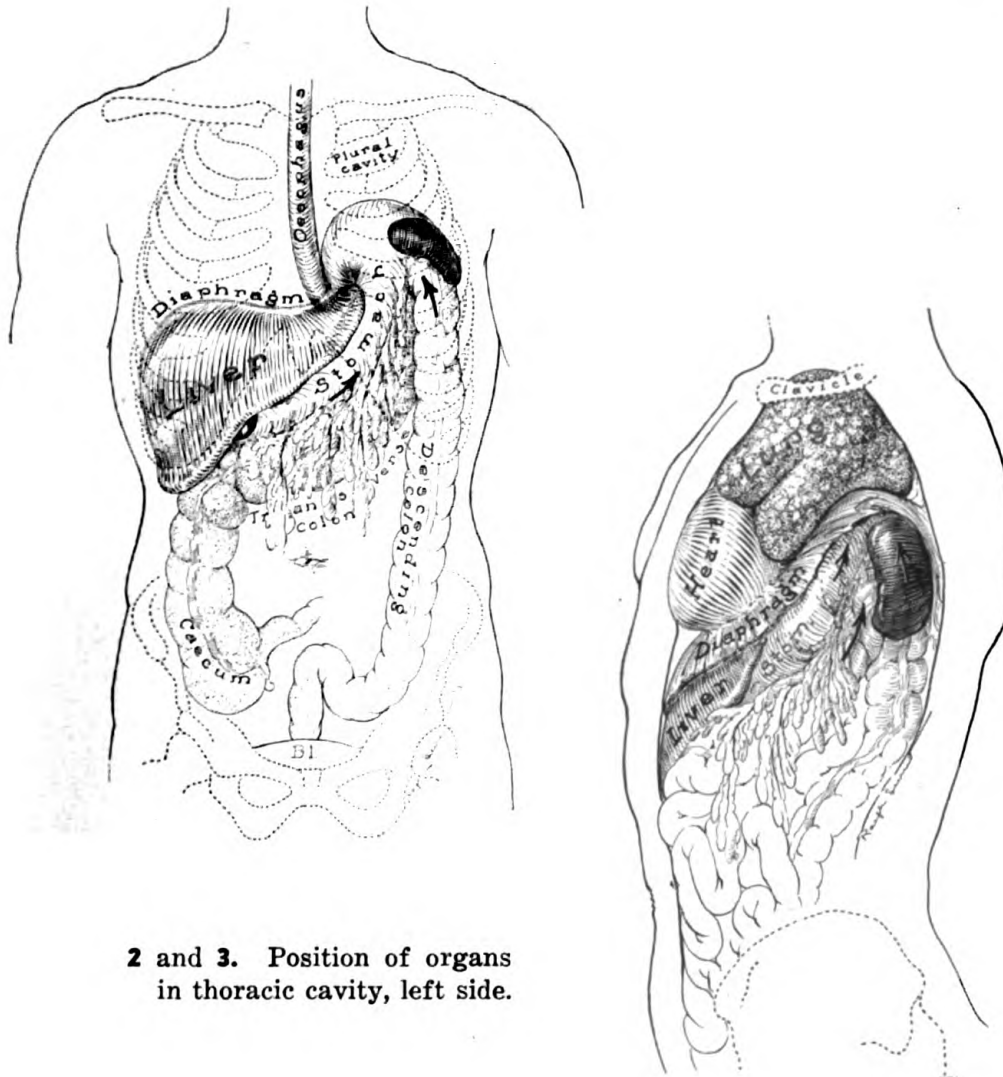
There were some difference of opinion as to whether this deformity was an eventration or a true hernia. An exploration was decided upon, and on 14 September the left phrenic nerve was crushed. Following this there was some paradoxical motion of the diaphragm. One month later, following a period of preparation, with a nasal-catheter stomach tube in place, and under intratracheal gas-ether-oxygen anesthesia, the diaphragm was explored



1. Preoperative x-ray examination showed the diaphragm to be high-lying on the left side.

through a left subcostal incision. All of the diaphragm except the central tendon was decidedly thinned out and bulged into the left thoracic cavity, the dome being 5 or 6 inches higher than the central tendon. The peritoneum was intact. The spleen, stomach, and the splenic flexure of the colon were displaced upward into this cavity (figs. 2 and 3).

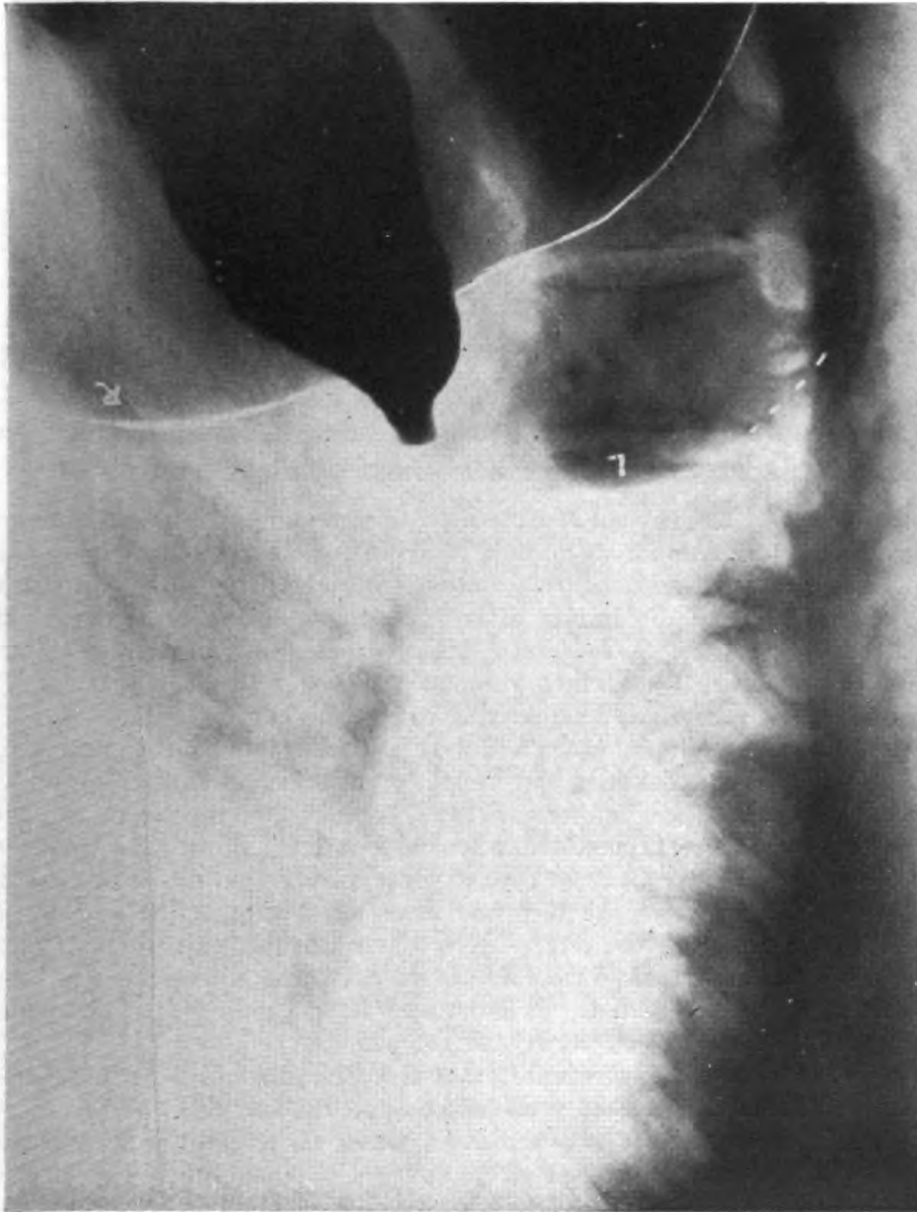
The stomach and colon were retracted downward (fig. 4, No. 1). The spleen was adherent to the dome of the diaphragm, and in mobilizing it the capsule was torn, resulting in a hemorrhage which necessitated its removal (fig. 4, No. 2). The highest portion of the concave dome of the thinner part of the diaphragm was grasped with several long forceps and retracted downward. Even with an attempt to inflate the lung, this portion of the dia-



2 and 3. Position of organs in thoracic cavity, left side.

phragm could not be brought down to the level of the central tendon until after an opening had been made through the diaphragm and a pneumothorax established. This portion of the diaphragm was then easily retracted into the abdomen and rolled on itself. The medial or more anterior portion of this cordlike roll of tissue, composed of thinned-out diaphragm, was sutured into the central tendon (fig. 4, No. 3).

The lateral or more posterior half of this roll of tissue was sutured to the thoracic wall, the last three stitches being secured to the tenth rib in the midaxillary line. On completion of the repair the diaphragm appeared as shown in figure 4, No. 4. A pack was placed against the suture line (fig. 4, No. 5) and allowed to protrude through the outer angle of the incision. The abdomen was then closed. The early postoperative convalescence of the patient was satisfactory. Several hundred cubic centimeters of bloody fluid was aspi-



5. Postoperative roentgenogram. The left lung is well expanded and the diaphragm is at normal level.

lateral angle of the wound. Injection of this sinus showed it to lie outside the abdominal cavity and to communicate with a lung abscess beneath the tenth rib posteriorly. This was unroofed and packed. Following this operation convalescence was uneventful and the patient was returned to limited duty.

CHRONIC CONSTRICTIVE PERICARDITIS

REPORT OF A CASE

WILLIAM T. MATLAGE, JR.

Lieutenant (MC) U.S.N.R.

This case is reported as one of chronic constrictive pericarditis, clinically diagnosed from the history and physical findings and the diagnosis confirmed by venous pressure determination, electrocardiography, fluoroscopy, and other diagnostic procedures.

Case report.—A 30-year-old Marine private came under observation because of dyspnea and abdominal distention. During his first week of boot training, 3 months previously, he had noticed an increase in the size of the abdomen and unusual discomfort after ingesting a heavy meal or drinking several bottles of beer. A few days later he had dull pain and swelling of the ankles and lower legs, which responded to bed rest and elevation. This ankle edema was recurrent, disappearing after a night's rest.

One month before admission, he had first noticed dyspnea on slight exertion, easy fatigability and weakness, and he had great difficulty in keeping up with the requirements of the training program. A little later he began to have a persistent cough, more pronounced when he was lying down; the cough was productive of large quantities of serous white frothy sputum. More recently he noticed some edema of the face and arms on arising in the morning but this disappeared during the day. There was some dull pain in both flanks. Gastro-intestinal symptoms were confined to a bloated sensation. His weight 6 months ago was 124 pounds, on enlistment it was recorded as 129 pounds, and on admission to the sick list it was 141 pounds.

His past medical history revealed that 5 years previously he had had all his teeth extracted because of periodontoclasia. He had had substernal pain for a few days on at least two occasions, which he thought was "pleurisy," and an unassociated severe throat diagnosed as tonsillitis. The personal history was noncontributory. Three years ago, his father-in-law, with whom there was close association, died of tuberculosis.

Physical examination showed the patient to be fairly well-developed and well-nourished, with a prominent, smooth abdomen and a mildly anxious expression. Respirations were shallow and rapid, 24 per minute. The veins of the neck, legs, and arms were prominent, and those of the neck and arms became quite distended and firm when the patient was in the dorsal position. A few small varicosities of the legs were noted. The patient's fingers were short and stubby, but there was no definite clubbing. No pulsations or retractions were found over the thorax anteriorly or posteriorly.

The blood pressure ranged from 100/78 to 115/85; the pulse rate was 96 at rest. All the cardiac first sounds were found to be diminished and the second sounds pronounced, the pulmonary second sound equaling the aortic second sound. There was normal sinus rhythm and no murmurs, thrills or

shocks were noted. There was diminution of the radial pulse with inspiration (pulsus paradoxus), best appreciated by auscultation with a blood pressure cuff partially inflated. The area of cardiac dullness shifted with change of position and was diminished on deep inspiration.

There was dullness to percussion at the bases of both lungs, with diminished breath sounds, fine moist râles, and decrease of diaphragmatic excursion. On full inspiration, without first hyperventilating, the patient was able to hold his breath 30 seconds, and after full expiration he could also hold it for 30 seconds. (Normal for this test is from 45 to 70 seconds on inspiration and from 20 to 30 seconds on expiration.) The abdomen was moderately distended, with flattening of the umbilicus, a fluid wave, and shifting dullness. The liver was definitely enlarged and tender. The spleen was not felt.

The blood Kahn test, complete blood count, sedimentation rate, icterus index, plasma protein determination, and urinalysis all yielded essentially normal results. In the bromsulfalein test 40 percent of the dye remained in the blood at the end of 15 minutes and 32 percent was still present at the end of 30 minutes. The venous pressure reading was 290 millimeters of water (normal for method used is from 50 to 120 millimeters).

The fluid obtained by abdominal paracentesis had the characteristics of a transudate, and on smear and culture was found negative for organisms and neoplastic cells.

Electrocardiographic findings showed the rate to be 92; sinus rhythm; the P-R 0.18 second, and the QRS 0.08 second. There was an inverted T and low slurred QRS in lead I; lead II also showed an inverted T and slightly slurred QRS; lead III an inverted T and low, slightly slurred QRS; and lead IV an inverted T and inverted P. The axis was normal (plus 53 degrees). The electric axis was altered by the change of position.

X-ray examination revealed a small amount of fluid in both thoracic cavities, more on the left side. Markings were increased in the lower lobes of both lungs. Several hilar calcifications were present. There was a large irregularly rounded calcification in the left side of the abdomen, probably in a mesenteric gland. The liver shadow was enlarged. A general haziness with lack of definition of the psoas and renal shadows was suggestive of ascites.

The most striking feature of fluoroscopic examination of the heart was the lack of motion, except for a very slight, stiff excursion of low amplitude discernible only along the left upper border. Slight shifts of the heart shadow upward with inspiration and also to the right and left in the semihorizontal positions were observed, but the general triangular shape of the shadow did not change with these changes of position.

The patient was given ammonium chloride, grains 30, for 2 days, then 1 cc. of mercupurin intravenously. The diuresis plus bed rest reduced his admission weight of 141 pounds to 132 pounds. His shortness of breath has diminished and the cough is only moderately productive. On restricted physical activity he is fairly comfortable and his weight is maintained at 138 pounds.

COMMENT

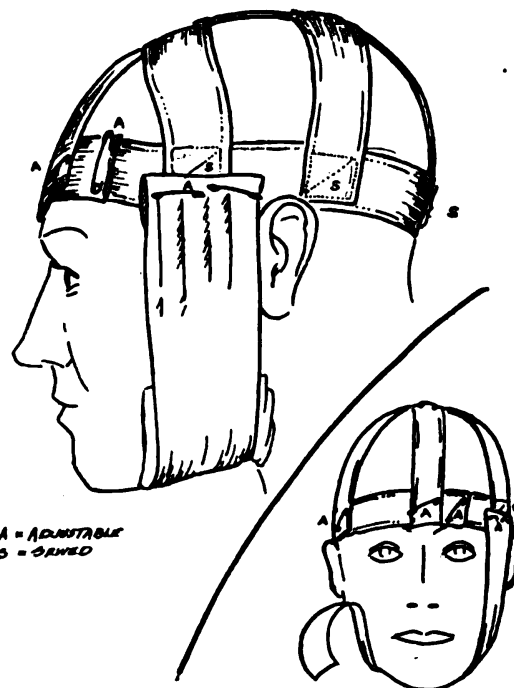
This case of chronic constrictive pericarditis is more a picture of concretio cordis as differentiated from chronic mediastinal pericarditis (accretio cordis). As is common in this condition, the cause is undetermined and tuberculosis is considered. Surgical correction of the D  lorme type (decortication of the heart) is indi-

cated, and this patient is considered a good surgical risk because of (1) the apparent inactivity of the infective process, (2) his age, and (3) the short duration of the symptoms and signs. It is of interest to note that, in spite of his disability, this man finished the Marine recruit training program in the designated time.



HEADPIECE FOR FACE WOUNDS AND JAW FRACTURES

A headpiece, consisting of a circular piece of light-weight muslin and three other pieces running across the top of the head,



has been found ideal for use in the field, on the beach, on ship, and in the hospital. It may be prepared in sufficient numbers prior to anticipated use. One piece runs from temporal region to temporal region, the point where most of the traction is desired; with this piece in place the circular piece will not be pulled out of position. Another piece, which is not absolutely necessary, runs over the parietal region. The

final piece, a cross piece, runs from the back of the head below the occipital lobe to the center of the forehead. One end of each of these three is sewed to one side of the circular piece, leaving the opposite ends loose. These three loose ends are left free and long enough to provide for adjustment to any head, as is the circular piece. This provides a ready adjustable headpiece. A minimum of safety pins are required for its application.—JORDAN, C. E., Lieutenant, junior grade (DC) U.S.N.R.

OSTEOPLASTIC REPAIR OF THORACIC CAGE DEFECTS

JOHN O. RANKIN

Lieutenant Commander (MC) U.S.N.R.

Traumatic bony defects of the chest wall may not only be disfiguring but are usually disabling. However there are a certain number of patients with chest wall injuries who could be rehabilitated. The case reported here is an example in point. The patient was admitted to the hospital as totally disabled, but after osteoplastic repair of the chest wall defect, he was able to return to a regular duty status.

Case report.—A gunner's mate, third class, age 21 years, was admitted to the hospital on 25 May 1944. He was ambulatory, but complained of tiring easily. He stated that any exercise caused quick fatigue and tachycardia. He was particularly aware of the pulsations of his heart through the chest wall and was quite concerned about the possibility of an injury to his heart, which he thought was just under the skin.

The patient's initial injury occurred while he was on authorized leave on the night of 10 February, when he was stabbed in the chest by another sailor during an argument. First aid was administered at an Army hospital. The next day, he was transferred to a Naval dispensary where an operation was performed for a cardiac tamponade. The patient's condition was apparently quite serious prior to operation, but this was followed by almost immediate relief of symptoms.

The operative report stated that the anterior ends of the fourth, fifth, and sixth ribs and their costal cartilages were removed and discarded. There was a 1-cm. laceration over the anterior wall of the left ventricle and a large branch of one of the coronary arteries had been severed, but as there was no active bleeding from either wound they were not molested. The blood in the pericardial sac was evacuated and the pericardium was closed.

Convalescence was uneventful. On 19 March the patient was transferred to a base hospital, and a few days later was evacuated to a hospital in the United States. On 25 April he was given a 30-day convalescent leave with orders to report to this hospital.

The personal and family history were irrelevant.

The physical examination revealed a well-developed and well-nourished male. The general physical examination did not reveal anything pertinent to the case. Examination of the chest showed a healed semilunar surgical scar, extending from the sternum to the anterior axillary line opposite the nipple, over the left side of the chest.

There was a circular depression in the chest wall over the heart, $4\frac{1}{2}$ inches in diameter. The surface was depressed approximately 1 inch. The pulsations of the heart were clearly visible, as though the apex were attached to the inferior surface of the skin, and on palpation one had the sensation that the apex of the heart was actually being grasped by the examining fingers.

X-ray examination on 1 June showed that the heart was globular in shape, but appeared within normal limits for size and configuration. There was absence of the anterior ends of the fourth, fifth and sixth ribs on the left.

Electrocardiographic findings on 7 June showed the rate to be 100, with sinus rhythm, P-waves normal, the P-R interval 0.08 second, and QRS 0.05 second. There was no axis deviation. There was definite straightening of the S-T segment in leads I and II, and it was slightly elevated in lead IV. The T-waves were upright and low throughout except T₁, which was inverted. The picture was consistent with that of residual myocardial damage.

On 6 July repair of the defect in the chest wall was made by the use of rib transplants, with the patient under pentothal anesthesia. The old surgical scar was excised and the skin flap turned up, exposing the defect. The pectoral muscles were dissected from the intercostals and retracted upward. Two gutters, 1 inch wide, were made in the intercostal muscles, exposing the pericardium. The first gutter extended from the end of the fourth rib to the sternum at the site of the former attachment of the fourth costal cartilage, and the second from the end of the fifth rib to midway between the former attachments of the fifth and sixth costal cartilages to the sternum.

The periosteum was opened at the ends of the fourth and fifth ribs. A small portion of the ends of the ribs was removed to give a raw surface. The side of the sternum was then split at the ends of the gutters with an osteotome.

The wound was packed and a second incision was made over and parallel with the ninth rib on the left side, centering in the midaxillary line. A section of the eighth rib, 6 inches long, was removed subperiosteally, and a similar one 5½ inches long was removed from the tenth rib.

The 6-inch graft, dovetailed at the anterior end, was placed in the upper gutter. One end of this graft was inserted into the split or cleft in the sternum and retained there with rustless steel wire inserted through a drill hole which penetrated the sternum and the end of the rib; the other end was wired to the anterior end of the fourth rib.

The 5½-inch graft was placed in the lower gutter and attached to the sternum in the same manner midway between the former attachments of the fifth and sixth costal cartilages. The other end was wired to the anterior end of the fifth rib.

The superficial portions of the intercostal muscles were sutured over the anterior surfaces of the rib grafts. The pectoral muscles were replaced and sutured in position. Sulfanilamide was dusted in the wounds and the skin was closed.

The patient had an uneventful convalescence. The wound healed by primary union. He was permitted to be out of bed at the end of 2 weeks and was given a 10-day leave to his home, a distance of 600 miles, on 1 August.

X-ray examination on 14 August showed that the loss of bone substance of the anterior ends of the fourth and fifth ribs of the left thoracic cage had been replaced by rib transplants which are in excellent position and alignment.

The cardiac shadow was of the globular type. The measurements were:

	<i>Predicted</i>	<i>Patient</i>
Long diameter	11.6 cm.	13.7 cm.
Broad diameter	13.4 cm.	10.5 cm.
Transverse diameter	12.4 cm.	T. R. 6.4 cm.
		T. L. 7.9 cm.
		Total 14.3 cm.

Frontal area 122 sq. cm. 113 sq. cm.

The long diameter of the heart was moderately increased as was also the right transverse diameter.

Electrocardiographic findings on 23 August showed definite evidence of improvement. The rate was 95; there was sinus rhythm. P-waves were normal, the P-R interval was 0.14 second, and QRS 0.06 second, there was no axis deviation, the S-T segment was elevated, T₁ was inverted, and there was improvement in the voltage of T₁ and T₂.

X-ray examination of the chest on 26 August showed no evidence of pathologic changes in either lung field. Both domes of the diaphragm were normal in position and contour. The cardiac shadow appeared to be slightly smaller than previously noted. The ends of the rib transplants were united to the anterior ends of the fourth and fifth ribs by bony union.

On discharge from the hospital to a regular duty status on 16 September the patient had no physical complaints. All symptoms of fatigue and tachycardia had disappeared, and he was no longer aware of the cardiac pulsations on the chest wall.

Physical examination revealed that the left wall of the chest was normal in appearance. There was no evidence of the former depression or defect. The cardiac pulsations were no longer visible. The site of the transplants was firm to palpation and pressure and was not tender.

There was no evidence of depression at the site from which the grafts were removed because a rib was left between the two that had been resected.

COMMENT

A résumé of the treatment of a patient disabled with a chest wall defect has been given. While this patient was not actually disabled in battle, the method used in repairing the defect could be applied in certain types of chest wall wounds incurred in battle.



STREPTOMYCIN IN TYPHOID

Streptomycin, a nontoxic antibiotic substance derived from *Actinomyces griseus*, when injected intravenously or intramuscularly in doses of from 1 million to 4 million units daily appears in the blood and urine in patients with typhoid in amounts theoretically sufficient to kill *E. typhosa*. Small quantities are excreted in the feces. When given orally, only traces appear in the blood and urine, and most of it is excreted unchanged in the feces in quantities excessive to suppress *E. typhosa* and *E. coli*. Both parenteral and oral therapy seem to be desirable in treating typhoid, the one to control systemic and urinary tract infection, the other to sterilize the feces, to prevent reinfection and to avoid the carrier state. There is evidence that different strains of *E. typhosa* vary in their resistance to streptomycin, but there is no evidence here of the development of increased resistance to streptomycin during exposure to it in the body. REIMANN, H. A.; ELIAS, W. F.; and PRICE, A. H.: Streptomycin for typhoid; a pharmacologic study. J.A.M.A. 128: 175-180, May 19, 1945.

CORONARY THROMBOSIS IN YOUTH

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Coronary thrombosis is fixed in the minds of many medical men as a disease of the sixth, seventh, and eighth decades. Some textbooks state that coronary thrombosis is "quite rare" below the age of forty. Yet in recent years many authors have emphasized the apparently increasing frequency of the disease in patients under 40 years of age. A summary of some of these reports as shown in the table below would seem to indicate that the disease is far from rare.

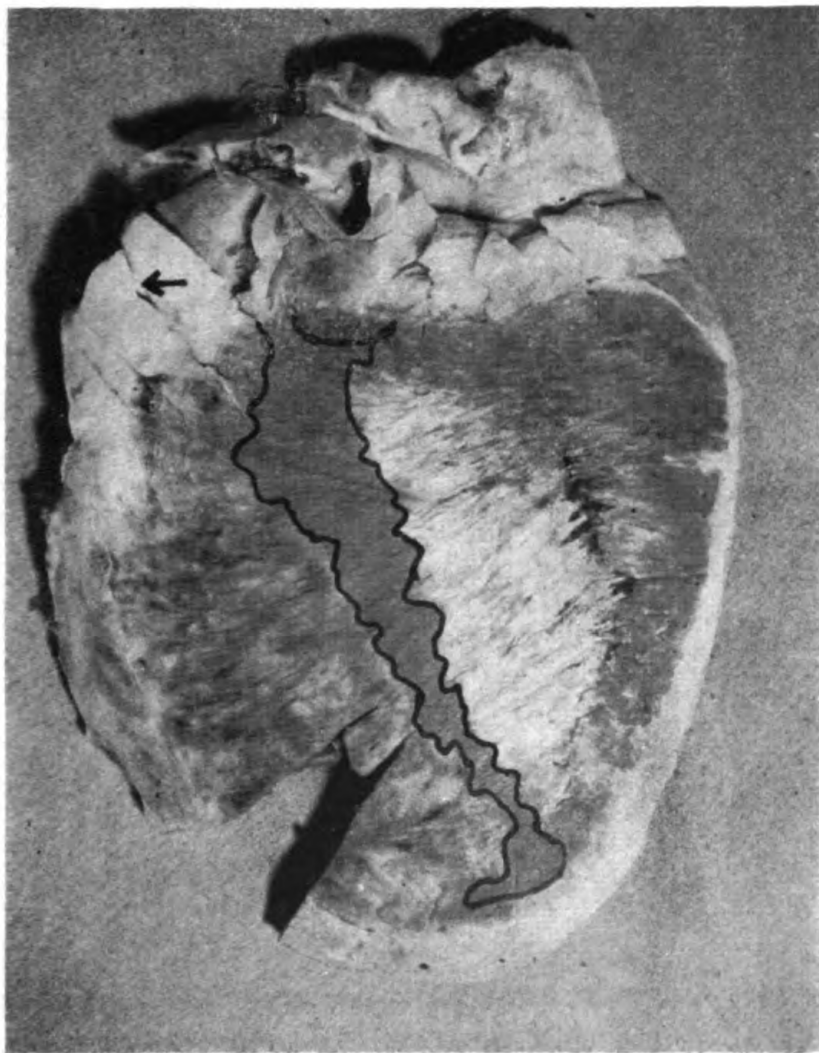
Cases of coronary thrombosis in recent literature

Author	Patients under 30 years	Patients aged from 30 to 40	Total cases in patients under 40
Glendy et al. (1).....	8	92	100
Miller and Woods* (2).....	3	—	3
Reitman et al. (2).....	34	187	221
Scott (2).....	28	180	208
White (3).....	4	10	14

* One case of their own. These authors could find only two other cases, in patients under 30 years, reported in the British Empire.

Zacks (4) in 1943 reviewed the literature and found eight cases of coronary thrombosis occurring in patients between the ages of 10 and 20 years. He added one case of his own, bringing the total to nine. On the other hand, when cases occurring in all ages are summarized, the peak incidence appears to be in the sixth and seventh decades. Connor and Holt (5), in reviewing 287 cases of coronary thrombosis in patients of all ages, found that only 1 percent had their initial attacks before the age of thirty. Master and his associates (6) found that in only 2 percent of 500 cases in patients of all ages did initial attacks occur before the age of thirty. That the disease is predominantly one of late middle age is not denied, but it is emphasized that coronary thrombosis can and does occur in all age groups. The following is a case in point.

Case report.—The patient was a 29-year-old Puerto Rican male who, except for frequent upper respiratory infections, had always enjoyed fairly good health. He was well able to perform his duties as a fireman, second class, for the 5 months he had been in the Navy. The day before admission to this hospital he experienced a sudden attack of chest pain and fell to the floor

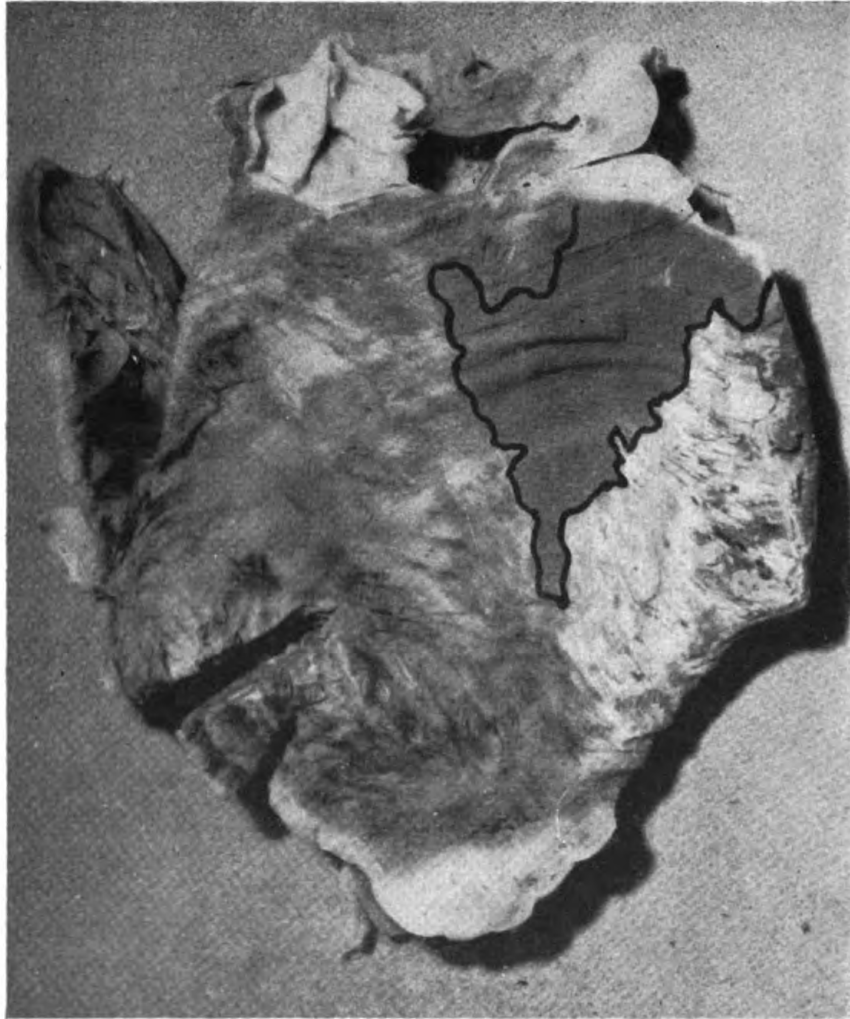


1. Sagittal section of left ventricle. The only uninvolved portion of the myocardium is shown heavily outlined. The arrow points to the site of a fresh thrombus in the anterior descending branch of the left coronary artery.

—Official U. S. Navy Photo.

unconscious. He was revived after a few minutes, at which time he complained of precordial pain and weakness in both arms. He began to cough and vomited once. He had no fever. Because of the cough and chest pain a chest x-ray film was taken. This showed "consolidation of the left upper lung field" and a diagnosis of pneumonia was made. The patient was transferred to this hospital the day following the attack.

On arrival here, the blood pressure was 90/60, temperature 101.2° F., pulse rate 122, and respirations 38 per minute. The patient appeared acutely ill, groaned in pain, and was very restless in bed. His tonsils were enlarged and inflamed, and the sputum was copious and blood tinged. The lungs and heart, extremities, and genitalia were normal. There was acute abdominal tenderness localized in the gallbladder region and associated with a suggestion of spasm in the upper right quadrant of the abdomen. The urine was normal, the sputum was negative for acid-fast bacilli and pneumococci. The leukocyte



2. Sagittal section of interventricular septum. The only portion of the myocardium that was not involved is shown outlined in heavy lines.

—Official U. S. Navy Photo.

count was 15,800, with 87 percent segmented cells. The blood Kahn test was negative.

Language difficulties prevented the taking of a good history. The patient complained only of severe non-radiating pain in the upper right quadrant of the abdomen. He was apprehensive and sweated profusely. He vomited once after admission and refused food. A surgical consultant expressed the opinion that the abdominal condition did not represent a surgical emergency and suggested continued rest and sedation. Thirty-four hours after admission the patient developed frank pulmonary edema and died suddenly before a diagnosis had been established. An electrocardiogram had not been made.

Necropsy findings.—The findings of interest were in the heart, which will be described in detail, the lungs, which showed the characteristic picture of acute edema, the liver, kidneys, and spleen, which were slightly congested. Of interest also is the fact that the gallbladder appeared normal.

The heart weighed 365 grams. It was in a normal position in an apparently normal pericardial cavity. The posterior portion of the epicardium over the left ventricle was white and slightly thickened, but was smooth and glistening.

Elsewhere the epicardium appeared normal. The myocardium of both auricles and the right ventricle appeared normal. The chambers of the right auricle and the right ventricle were slightly distended and filled with dark-red clotted blood. The chambers of the left auricle and left ventricle were of average size. All valves appeared normal.

The myocardium of the interventricular septum and of the left ventricle was a mass of infarcts ranging from glistening, tough, pearly-white fibrous areas posteriorly, to mottled dull yellow and gray areas anteriorly, with dark-red irregular streaks peripherally (figs. 1 and 2).

The white fibrous area extended in places in the left ventricle from the trabeculae carneae to the epicardium. This coarse fibrous tissue resembled muscle aponeurosis more closely than it did myocardium. The infarct was obviously of very long standing and represented a completely healed lesion that the patient had, for many months or possibly years, been able to compensate for and tolerate. The posterior descending branch of the right coronary artery, the chief blood supply to this area, was represented by a completely occluded fibrous cord.

The more recent and fresh areas of infarction in the anterior left ventricle and in the anterior interventricular septum were supplied by the anterior descending branch of the left coronary artery. This artery showed arteriosclerotic narrowing throughout its length, reaching pinpoint size at a point 2 cm. below the bifurcation of the artery. Just above this point of extreme narrowing in the anterior descending branch, a fresh thrombus completely occluded the lumen. The thrombus was dark red, firmly attached, and extended along the lumen for a distance of about one centimeter.

Other portions of the coronary arteries showed various degrees of arteriosclerotic thickening, but the two coronary orifices were amply patent. Other vessels throughout the body showed minimal to no arteriosclerotic changes.

Microscopically the myocardium showed extensive muscle damage, ranging from old scar tissue to necrotizing muscle fibers. In the areas of muscle necrosis there was dense segmented cell infiltration. In other areas there was evidence of fresh hemorrhage.

Sections through the coronary arteries showed various degrees of arteriosclerotic thickening of the walls. There were numerous irregular atheromatous deposits containing cholesterol crystals in the subintimal layer. These deposits were covered with intima, but had totally or partially destroyed portions of the media. In the region of pinpoint stenosis of the anterior descending branch of the left coronary artery there were a few bloodless canaliculi. These were located at the periphery of an old fibrosed thrombus. The functional lumen, which was also located eccentrically, was plugged with a fresh thrombus.

The kidneys, liver and spleen appeared normal except for acute congestion. Their blood vessels showed no arteriosclerotic changes.

Edema fluid filled most of the pulmonary alveoli. The alveolar vessels were dilated and engorged. Other organs appeared normal microscopically.

SUMMARY AND CONCLUSIONS

A case is presented of remote occlusion of the posterior descending branch of the right coronary artery with extensive healed infarction, and recent occlusion of the anterior descending branch of the left coronary artery with fresh infarction, occurring in a 29-year-old male. From the clinical point of view this is added

evidence emphasizing the importance of considering coronary heart disease in the differential diagnosis of chest and upper abdominal pain, regardless of the age of the patient. From the point of view of the pathologist this case demonstrates extremely severe and extensive cardiac damage in all stages of repair. A brief summary of reported cases of coronary thrombosis occurring in patients under 40 years of age is given.

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INTERSTITIAL FLUID IN BURNED PATIENTS

If therapy has not been started within 3 or 4 hours after the burn, the patient shows at that time a picture of over-all dehydration. There is a decrease in the interstitial fluid volume, a decrease in plasma volume with increased plasma protein concentration, and a decreased red cell volume. As soon as therapy is begun, a shift begins to take place which can be characterized as a massive influx of water and protein to the interstitial space. At the peak of this phenomenon, the patient shows a tremendous enlargement of the interstitial fluid space with a decreased total blood volume and a normal, or nearly normal, plasma volume with decreased total blood and a normal, or nearly normal, plasma volume with decreased plasma protein concentration.—MOORE, F. D., and COPE, O.: Fluid and protein shifts in severely burned patients. *Bull. Am. Coll. Surgeons* 30: 65, February 1945.

MECKEL'S DIVERTICULUM

REPORT OF A CASE

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Meckel's diverticulum represents the incomplete regression of the omphalomesenteric duct and the persistence of this structure beyond the first few weeks of fetal life. It arises from the anti-mesenteric border of the ileum at an average of 20 inches proximal to the ileocecal junction. This diverticulum has been estimated to occur in from 2 to 4 percent of infants.

Pathologically this residual structure is subject to a variety of changes which may be enumerated briefly as follows:

1. It may be attached to the umbilicus without any external communication. In this case the symptoms produced may be simply those of intermittent abdominal pain.

2. It may be attached to the umbilicus with a patent external opening, and in this condition the symptoms are those of any fecal fistula.

3. Its distal end may lie free and may become adherent almost anywhere in the abdomen. A loop of bowel may thus be caught beneath it, causing intestinal obstruction.

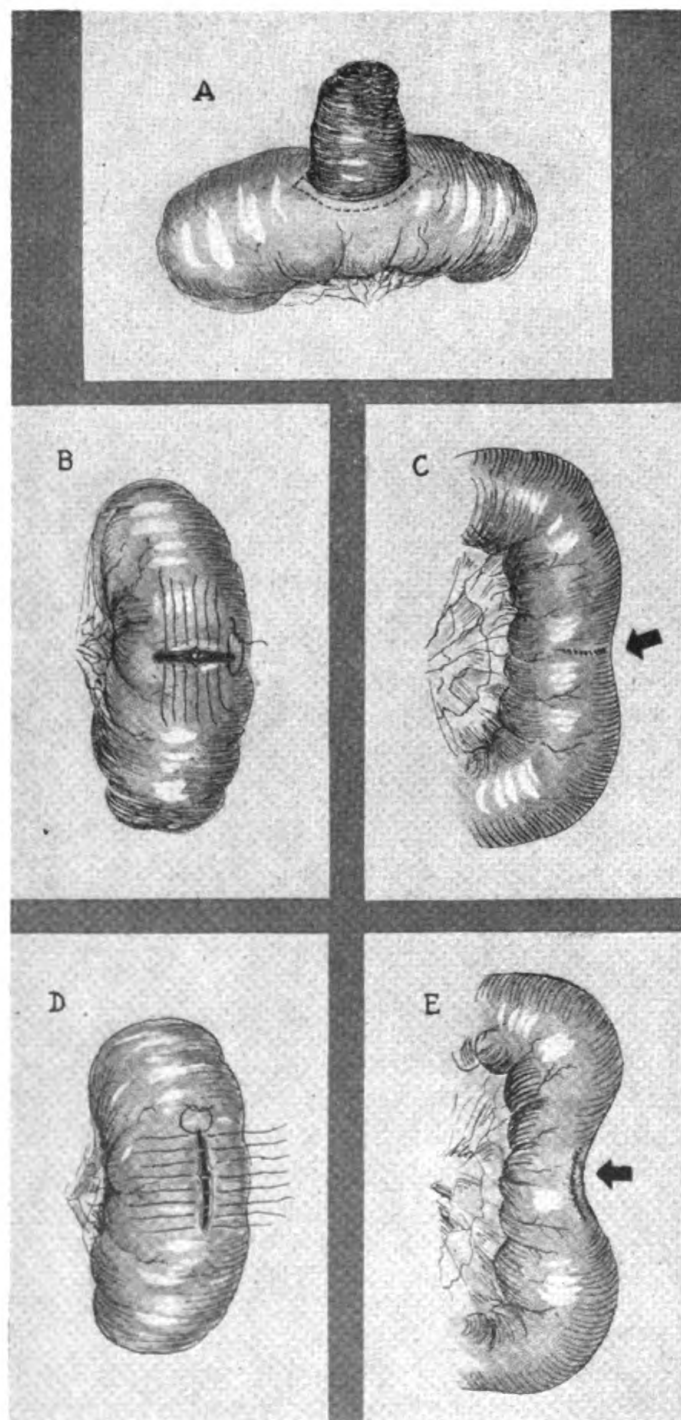
4. It may become acutely inflamed. The symptoms may then simulate those of acute appendicitis.

5. It may contain such heterotopic tissue as gastric or duodenal mucosa. Hemorrhage due to ulceration is a frequent sign under these circumstances.

6. The distal end may become inverted into the lumen of the bowel, producing an intussusception.

7. It may also be the site of tumor formation derived from the tube or the aberrant tissue.

The treatment of Meckel's diverticulum is surgical, aiming at the correction of any of the variety of pathologic conditions encountered. In all cases the diverticulum is to be removed. Treating the base of the diverticulum, which is usually rather wide, as an appendiceal stump with purse-string inversion, will invariably produce bowel constriction, and subsequent acute obstruction is likely to follow such a surgical technic. The recommended procedure is a transverse incision at the base followed by a transverse



Technic for surgical correction of Meckel's diverticulum. **A.** The defect. **B.** Transverse cut and closure. **C.** Mild bowel constriction. **D.** Axial cut and closure. **E.** Marked bowel constriction.

closure. This method results in a minimum of bowel constriction.

The following case report will serve to illustrate the technic.

Case report.—An 18-year-old seaman was admitted to the hospital complaining of severe cramping pain in the lower abdomen. The pain had been present nearly 12 hours prior to admission, increasing gradually in intensity and accompanied by several incidents of vom-

iting. He was unable to localize the pain to any one spot, and there was no radiation to any other region and no urinary symptoms.

The patient had experienced a similar though milder episode about a year before for which an appendectomy had been done. Mild and infrequent episodes of "cramps" had persisted after the appendectomy.

Examination showed a lean, wiry youth in obvious distress. The abdomen appeared flat and symmetrical. There was muscle spasm of the entire lower abdomen with tenderness and rebound tenderness most pronounced midway

between the umbilicus and the pubis. A firmly healed McBurney incision was present, and there was no clinical evidence of pathologic changes here or in any of the other hernial sites. The temperature was 100° F., pulse rate 88, and respirations 20 per minute. The remainder of the physical examination, including a digital rectal examination, did not disclose any further pertinent abnormalities. Laboratory study showed a leukocyte count of 14,000 with 84 percent polymorphonuclear cells. The urine was normal.

A diagnosis of localized peritonitis was made, and in view of the history of previous appendectomy performed for similar symptoms, the possibility of a Meckel's diverticulum was recorded.

A laparotomy was carried out, with the patient under ether anesthesia, utilizing a right rectus incision. A firm tumor-like mass was encountered within the loops of small bowel in the lower part of the midabdomen. The mass was revealed as sharply localized, deeply reddened and covered with a fibrinous exudate, to which several loops of bowel were freshly adherent. Another loop of bowel passed beneath the mass and appeared moderately constricted.

After packing off the surrounding peritoneal cavity, the freshly adherent bowel was gently and easily freed, permitting complete delivery of the bulbous inflammatory structure. It was apparent that this structure projected from the free border of the loops of bowel from a base about one inch in diameter. The bulbous tip appeared gangrenous and the rest of the diverticulum showed the acute suppurative changes seen typically in appendicitis.

The diverticulum, which measured approximately $1\frac{3}{4}$ inches, was amputated between clamps close to the intestinal margin. The bowel wall was closed with a continuous suture of fine chromic catgut on an atraumatic needle. A second layer of interrupted Lembert sutures completed the closure. Some constriction of the bowel lumen was apparent after closure, although the probability of secondary obstruction was deemed unlikely. The abdomen was closed in layers without drainage.

Shortly after operation, mild abdominal distention appeared, and Wangenstein suction was instituted. Within 48 hours all symptoms had subsided and from then on the patient made an uneventful recovery.

The pathologic report confirmed the gross findings of an acute suppurative process and no aberrant tissue was found microscopically.

COMMENT

This case illustrates the inflammatory type of pathologic change resulting from a Meckel's diverticulum stretching across a loop of bowel and becoming adherent to other loops. The likely outcome in this case would have been peritonitis and acute intestinal obstruction. It is not difficult to realize, therefore, that an appreciable mortality is associated with this condition. Preoperative diagnosis is obviously difficult. Avoidance of grave complications depends on the routine exploration of the ileum for this lesion, especially in those appendectomies in which little if any pathologic tissue is found.

SPLENIC INJURY

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Of all the serious injuries to abdominal viscera, rupture of the spleen is probably the one most often overlooked in early diagnosis. It is produced in the main by a crushing type of violence, such as automobile accidents, falls from a height, and sudden blows on the left lower part of the chest or the upper part of the abdomen. When rupture of the spleen occurs as a single injury or in combination with obviously minor injuries it is not so likely to be overlooked. But in the nature of the violence from which it frequently results there are more often than not clearly discernible serious injuries to other tissues which in themselves produce severe shock and collapse.

Severe fractures of the femur, humerus, pelvis or spine, head injuries, damage to thoracic organs or massive avulsions of soft tissue with observable blood loss, are apt completely to obscure the symptoms of an accompanying splenic injury with hidden hemorrhage.

The spleen is partly supported by the phrenocolic ligament of the left flexure of the colon. It is in apposition with three relatively fixed tissues: The diaphragm over its convex surface; the upper anterior surface of the left kidney posteriorly; and the tail of the pancreas below and at the hilus. The actual supports (phrenocolic and gastrosplenic ligaments) which converge at the hilus into a short pedicle, are thin folds of peritoneum derived on the outer surface from the peritoneum of the general abdominal cavity and on the inner side from the lesser sac. The terminal branches of the great splenic vessels lie in these peritoneal folds and constitute the splenic ligaments.

These anatomic considerations influence the type and character of splenic injury. The peritoneal ligaments are not strong enough to resist sudden blows displacing the spleen sufficiently to tear the hilus vessels, which are more or less fixed by their relation to the body and tail of the pancreas. Such tears at the hilus may give rise to violent hemorrhage without appreciable damage to the parenchyma of the spleen. Severe compression may squeeze the spleen between the chest wall and the anterior surface of the left kidney or against the spine and produce a fracturing effect,

with or without actual separation of the fragments, or produce hemorrhage under tension within the parenchyma.

Hemorrhage from hilus tears will seldom cease spontaneously. Fracture of the parenchyma may give rise to bleeding which stops spontaneously and is followed by recovery without recourse to surgery, although this result is not to be expected. Minor injuries of the spleen with only moderate blood loss are probably more common than is ordinarily realized. However, many days after an injury to the spleen, which has seemed to do well without surgery, secondary hemorrhage may occur. Such secondary hemorrhage is attended by a high mortality.

Exploration and surgery is indicated in known splenic injury. The problem is merely one of recognizing such injuries early, and the diagnosis must often be made upon meager evidence. Indications of concealed hemorrhage, not otherwise accounted for, with various grades of tenderness over the upper left quadrant of the abdomen and under the left costal margin, with even slight muscle spasm, in a patient who has had a severe trunk injury, are sufficient to justify surgical exploration.

The majority of splenic injuries with bleeding are more surely and safely handled by removal of the spleen. Splenectomy in an otherwise healthy person is not followed by any persistent loss to the body economy. In the young after removal of the spleen, its function is restored through hypertrophy of hemolymph nodes and by accessory splenic tissue.

Two cases may be cited, the first illustrating some of the difficulties of early diagnosis of rupture of the spleen, the second illustrating the intra-abdominal findings several years after the removal of a ruptured spleen in a young man.

Case 1.—A Marine paymaster sergeant was admitted to the hospital in severe shock. He was dazed but conscious, and complained of an agonizing pain in the lower half of the sternal region of the chest. There was a contused and lacerated wound immediately adjacent to and below the concha of the left ear. He was unable to give any details of his accident. All he remembered was that he was riding back to his quarters from the movies in a jeep. The men who picked him up said they had found him in the front seat of a jeep which had gone off the road and run into a pile of oil drums. The car was battered and the steering wheel bent.

Examination disclosed pallor, cold sweat, a rapid, thready pulse, and blood pressure of 100/60 which rapidly dropped to 90/50. The appearance of the chest was normal, but pressure over the sternum and compression of the lateral walls was productive of excruciating pain referred to the lower portion of the sternum. The abdomen was flat, soft and nontender. The patient seemed to have no discomfort associated with the abdomen.

There were no other signs of injury. X-ray examination of the chest shortly after admission disclosed parenchymal damage in the left lung without fluid

or air in the pleural cavity. X-ray examination of the skull showed no abnormality. The principal injuries were believed to be those of the head and chest, and the admitting diagnosis of probable fractured skull with intracranial injury was accepted temporarily. Administration of plasma and morphine rapidly reduced the symptoms of shock.

Some 8 hours later the patient seemed quite cheerful and clear mentally. Although he still complained of pain in the lower half of the sternal region, he stated that this was much improved over the night before. However he was very pale and inspection of the tongue and buccal mucosa showed them to be blanched. The blood pressure was 100/60 and the pulse was rapid and weak. There was no abdominal complaint and no pain in the left shoulder. Examination disclosed exquisite tenderness over the lower half of the sternum, particularly at the junction of the lower costal cartilages.

The abdomen was flat, soft and nontender except to a very slight degree under the left rib margin. A slight protective muscle spasm high on the left side was induced by pressure at the left costal margin. Posteriorly over the lower four ribs on the left side, and over the left costovertebral angle, there was acute tenderness. The erythrocytes at this time numbered 3,500,000 per cubic millimeter. There were clearcut signs of concealed hemorrhage. A diagnosis of ruptured spleen was made on these meager findings.

Exploration conducted under spinal anesthesia through a long left rectus incision from the ensiform process to 1 inch below the umbilicus, showed the abdomen to be filled with blood. The spleen was torn along its anterior border and at the attachment of its pedicle; from the latter site there was active bleeding. Blood was aspirated from the peritoneal cavity, the spleen was removed and the abdomen closed. A transfusion of 1,000 cc. of blood was started before and continued during and after the operation. One subsequent transfusion of 500 cc. was given on the seventh postoperative day. Convalescence was progressive and uneventful with complete recovery of the patient and return to duty.

Case 2.—A 29-year-old patient was admitted to the Fleet hospital on 16 May 1944 with symptoms of a partial intestinal obstruction. X-ray films showed evidence of pocketing of gas in the jejunum. In 1938 splenectomy had been performed for traumatic rupture incurred in an automobile accident. He had also had a simple appendectomy done in April 1943.

On physical examination the only possibly significant finding was in the abdomen, which was thin-walled and not distended except for slight tympanic prominence in the left half at and above the level of the umbilicus. There was a long left rectus incisional scar with a T-shaped extension at right angles across this muscle to the costal margin, and there was also a McBurney's incision scar. The abdominal muscles were of poor tone. There was tenderness over the lower part of the left rectus muscle scar and over the slight prominence in the left side of the abdomen. Over this area there were signs of hyperperistalsis.

Three days after admission, exploration was conducted under spinal anesthesia through the old left rectus muscle scar. A cord-like adhesion, 4 cm. long and 2 mm. in diameter, extended from one loop of the upper ileum to the parietal peritoneum on the left side of the abdomen, causing an angulation of this loop. The bowel proximal to this was moderately distended. The adhesion was divided. In the midjejunum a reddish blue, roughly almond-shaped tumor 2 by 1 by 1 cm. was encountered lying under the serosa of the antimesenteric

border of the bowel; it lay in the long axis of the bowel and impinged upon its lumen.

The tumor mass was removed and the bowel wall repaired. The bowel musculature proximal to this tumor was hypertrophied. Along the greater curvature of the stomach there were numerous similar tumors. There were also several along the lower margin of the transverse colon and studded in the substance of the great omentum. Several specimens were removed for study. Throughout the mesentery of the small bowel there were clusters of enlarged lymph nodes. One of these was removed for study. The liver and other abdominal organs were normal.

The abdomen was closed in layers. The patient's recovery from the operation was relatively uneventful, though some abdominal discomfort after meals persisted during his hospital stay.

The specimens were studied microscopically. Section of the mesenteric lymph node showed simple hyperplasia. The small tumorlike masses removed from the omentum and along the stomach and colon and the wall of the jejunum were seen on section to be hyperplastic hemolymph nodes, having taken on the characteristics of splenic tissue except for the trabeculae. One mass was a small accessory spleen. These changes are physiologic and resulted from the removal of the spleen in a young adult.

This case is presented only to illustrate the end-results of splenectomy which had been performed 6 years previously.



PENICILLIN AEROSOL

An exploratory study of the effectiveness of penicillin aerosol therapy in 20 patients with bronchopulmonary infection revealed: (1) The predominating organisms in the sputum culture were consistently absent 24 hours after discontinuance of treatment; and (2) the blood level of penicillin for one hour following inhalation of the aerosol was generally between 0.01 and 0.04 unit, at times as high as 0.18.

The 20 cases treated suffered from (a) various combinations of bronchial asthma, bronchiectasis, and pulmonary emphysema; (b) bronchiectasis with and without chronic lung abscess; (c) pulmonary fibrosis and emphysema; and (d) acute lung abscess. In 5 patients the improvement was striking and seemed definitely the effect of inhalation of penicillin aerosol. In 10 others improvement was moderate, and in the remaining 5 cases no significant clinical benefit was achieved. Of the 15 improved cases, 7 suffered a recurrence of symptoms in 2 months or less. Further studies on the effect of penicillin aerosol are indicated in (a) bronchial asthma with bronchial infection; (b) bronchiectasis; and (c) acute lung abscess.—BARACH, A. L.; SILBERSTEIN, F. H.; OPPENHEIMER, E. T.; HUNTER, T.; and SOROKA, M.: Inhalation of penicillin aerosol in patients with bronchial asthma, chronic bronchitis, bronchiectasis and lung abscess: preliminary report. *Ann. Int. Med.* 22: 485-509, April 1945.

INFRATEMPORAL ABSCESS OF DENTAL ORIGIN

GEORGE W. CHRISTIANSEN

Commander (DC) U.S.N.R.

and

JAMES L. BRADLEY

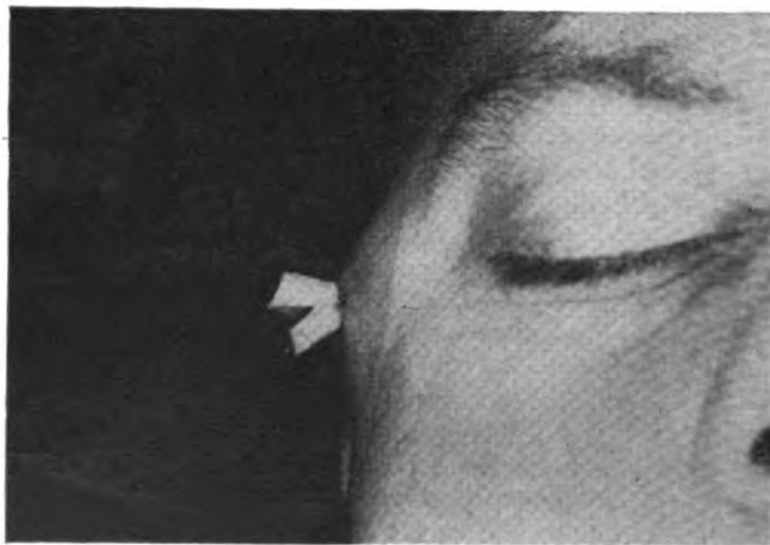
Lieutenant Commander (DC) U.S.N.

The causes of swelling in the temporal region of the face are many. Of especial concern to the oral surgeon, however, is the infratemporal abscess of dental origin.

This condition may result from periodontal and periapical infection, or by secondary infection following extraction of a tooth. The pus lying under the dense temporal fascia cannot escape readily and may burrow medially through the emissary vein openings to the brain. For this reason extra-oral incision to establish adequate drainage is necessary when the swelling is reasonably large and fluctuant.

Prior to incision a thorough examination is essential; specific medication and moist applications are administered for at least 24 hours. After incision a drain is placed deep in the wound and allowed to remain for an appropriate period.

Case report.—The patient, aged 31, complained of swelling in the right temporal region and inability to open the mouth following the removal of a maxillary right third molar 2 weeks previously.



1. Lateral view of the swelling above the superficial temporal fascia.



2. Side view of face, showing the incision and rubber dam drain.

Examination showed him to be a well developed male. The temperature was but slightly elevated. The swollen area was mildly fluctuant and trismus was noticeable. A blood Wassermann test was negative. The leukocyte count was 11,200.

Sulfanilamide therapy was begun and moist dressings for 24 hours were ordered. The following day an incision was made on a level with the external canthus of the eye down to the temporal fascia. No fluid was found at this depth, but further incision through the fascia yielded a purulent material apparently under pressure. A rubber drain was placed deep in the incision (figs. 1 and 2). Healing was rapid and uncomplicated.

COMMENT

Swelling in the temporal region following the removal of maxillary impacted third molars is not rare. When infection develops in such cases the route is probably upward and medially across the pterygomaxillary fossa to the infratemporal region under or between fascial planes. If the swelling is reasonably large and fluctuant, extra-oral incision is indicated.



PREVENTION OF GAS PAINS

Swallowed air is the main source of gas in the bowel following operations. It is advised that Wangensteen suction be instituted during the anesthesia and surgical procedure, as well as in the immediate postoperative period, to evacuate the gas as it enters the stomach and so prevent its entrance into the bowel.—DAVIS, H. H., and HANSEN, T. M.: Investigation of cause and prevention of gas pains following abdominal operation. *Surgery* 17: 492-497, April 1945.

UNIVERSAL ALOPECIA

REPORT OF A CASE

BERNARD M. SCHOLDER

Lieutenant Commander (MC) U.S.N.R.

and

ARTHUR P. MORTON

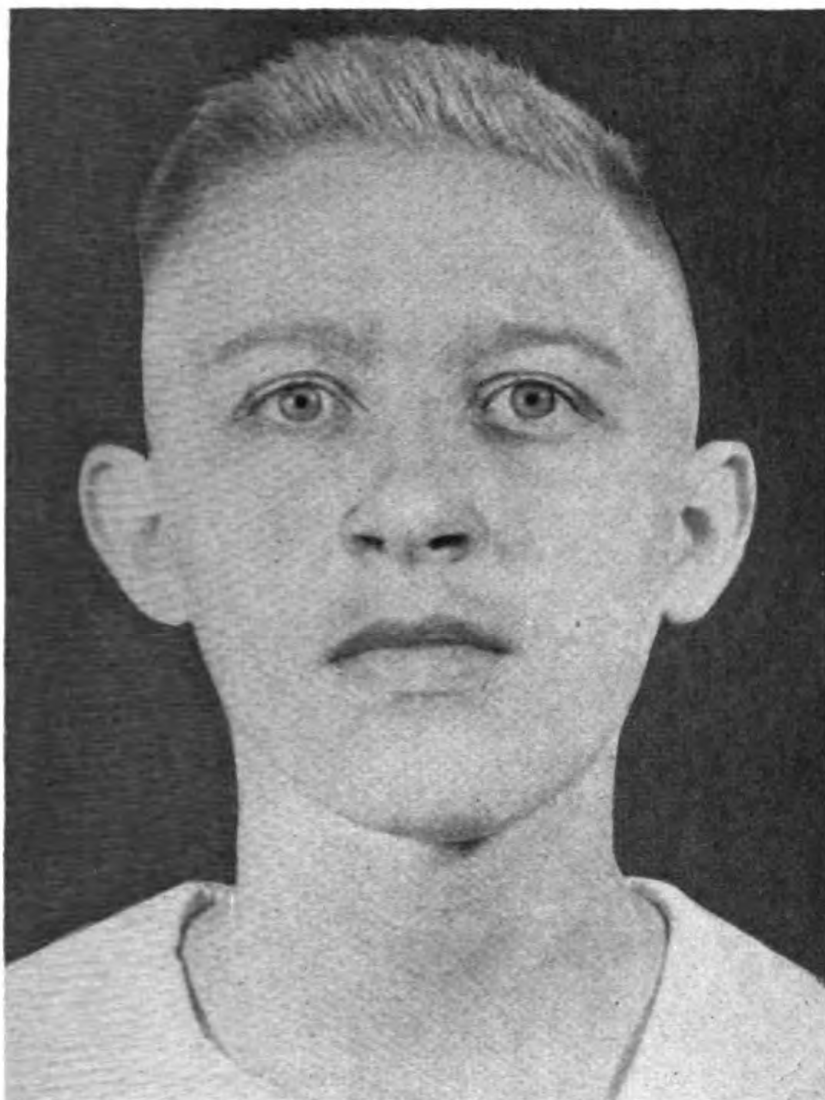
Captain (MC) U.S.N.

Universal or "malignant" alopecia is quite rare and hence when it occurs is worthy of special note. Although Waisman and Kepler (1) were able to report 138 cases, inasmuch as no definite time limit is stated it is assumed that this number represented the total number in the files of the Mayo Clinic up to 1941. The experiences at that clinic are so vast that the large number presented should not be taken as indicating frequency of occurrence. This BULLETIN'S index from 1929 to 1943 does not disclose a single report of such a condition. Perusal of the general literature likewise emphasizes the relative rarity of the condition.

The disease occurs at all ages, being equally distributed between the sexes in childhood but more common among males after puberty. The greatest incidence is in the third decade of life.

The etiologic factors have been divided into neuropathic, infectious and toxic. The latter two can be applied to those specific cases in which the cause can be definitely proved. But the great majority of cases appear to occur spontaneously, and it is in these cases that the neuropathic concept applies best. Ormsby and Montgomery (2) state that universal alopecia "has been observed to follow the obscure disorders of the nervous centers due to undue excitation, sudden or prolonged." Heredity may play a role as suggested by Sabouraud (3). Shelton and Hollander (4) reported this condition in a father and daughter. The implication of the endocrine system is not warranted in view of Waisman and Kepler's careful analysis. Indeed in the large experience of these authors no single factor seemed significant.

Case report.—A 19-year-old seaman, first class, applied to the sickbay on 29 August 1944 for treatment of baldness. He had enlisted in the Navy on 17 June 1943. In December he was assigned to a new tanker. Two days out of port, about 1 January 1944, he noted that his hair was falling out. Within two days all hair was gone from his head, eyebrows, eyelashes, axillae, pubic region, and extremities. His battery officer sent him to the purser, but he



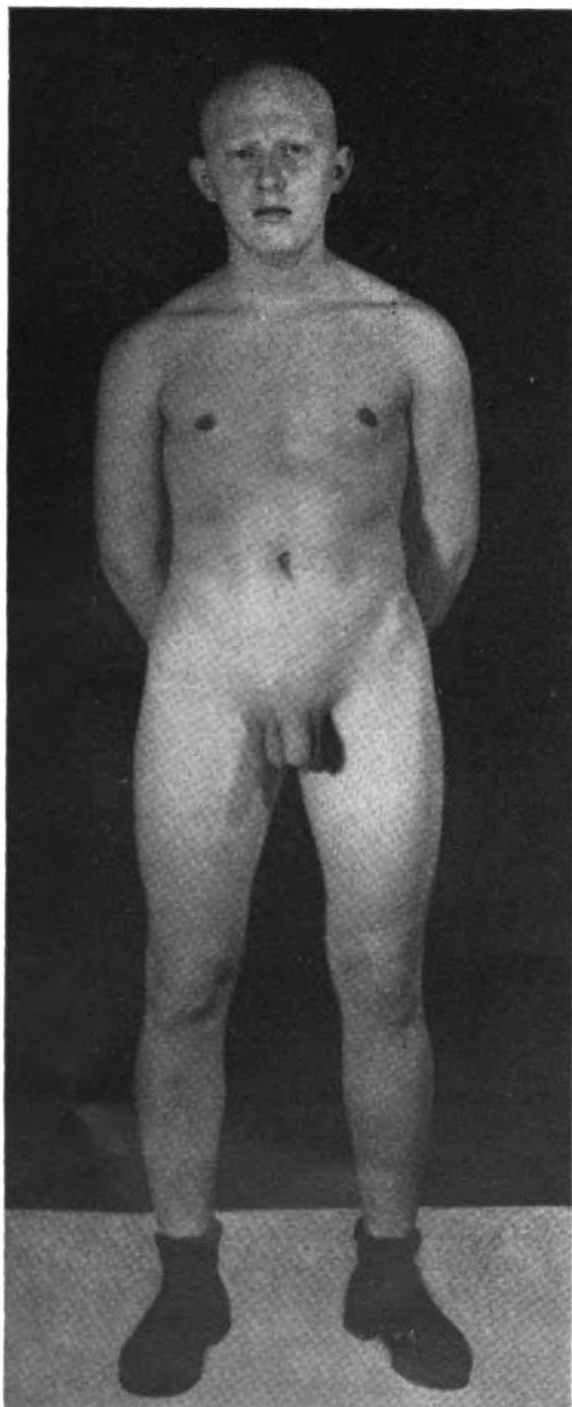
1. Appearance of patient in June 1943 at the time of his induction into the Navy.

states that "the purser laughed" at him. From then until he presented himself at this sickbay he did not consult any medical officer because he "felt selfconscious" about his condition.

During the months from January to August the patient spent his time on the ship. Life was "miserable" for him because of the way his shipmates used to "rib" him; he stated that he was afraid he might "do something serious." He became extremely gun-shy and unable to perform regular duties aboard ship; nervousness was pronounced and nail-biting increased.

The patient did not recall when he first developed axillary or pubic hair, but he said he did have a full crop. He shaved about once a week, his "beard" consisting of fuzz. He had a normal sex development and has had normal satisfactory sexual intercourse, although he has tended lately to avoid the company of girls.

The patient is an only child. In September 1942 his father committed suicide. The patient was taken to the morgue to identify his father's body. Fol-



2. General appearance of the patient in September 1944.

Following this experience, he related, he became "sick and wouldn't eat, wanted to be left alone," became argumentative and "lost my head." This lasted about one week and although he improved, he remained extremely nervous (was easily frightened and thought he was being followed). He has been an occasional nail-biter and while in training camp was gun-shy and "afraid and nervous of fights." He was fearful of being torpedoed and of going into action.

His past medical history revealed that he had had mumps, measles and frequent sore throats. At about 5 or 6 years of age a mastoidectomy was performed. When he was 15 years of age he sustained a head injury in an automobile accident, but there were no sequelae. At about this time also a foot infection developed as a result of an accidental knife wound.

He completed 2 years in a high school for automotive trades. At the age of 16 he began to work and in about 11 months prior to his enlistment had held several jobs.

Physical examination revealed a well-developed and well-nourished male, of striking

appearance because of the smooth shiny skin. The head was completely bald and eyebrows, eyelashes, hair in the ear canals, and nasal vibrissae were missing; no hair was present in the axillary or pubic areas. Occasional fine, blonde lanugo-like hair strands were seen on the face.

Figure 1 shows the appearance of the patient in June 1943. Figures 2 and 3 show the change in September 1944. The remainder of the physical examination disclosed no further abnormalities. The genitalia were well developed. The fingernails showed the results of effective nail-biting. The reflexes were active and equal.



3. Close-up of axillae showing absence of hair.

X-ray examination of the skull showed a normal sella turcica; that of the chest showed it to be normal.

Neuropsychiatric examination revealed evidences of a mild anxiety state. The patient was "nervous" and irritable, easily upset by fights, brawls and arguments, and still had the feeling of being followed. The tendon reflexes were active. There was a slight fine tremor of the outstretched hands.

Laboratory studies included urinalysis, blood studies and basal metabolism determination. The urine had a specific gravity of 1.025 and an acid reaction. Microscopic examination showed occasional leukocytes and numerous epithelial cells with occasional clumping.

Blood studies showed a hemoglobin content of 75 percent, an erythrocyte count of 3,830,000, a leukocyte count of 6,800 and a differential count of 70 percent segmented cells, 29 percent lymphocytes, and 1 percent monocytes. The sedimentation rate was 3 mm. in 30 minutes and 9 mm. in 1 hour. The blood urea nitrogen was 19.05 milligrams per 100 cc.; the blood sugar 113 milligrams per 100 cc.; the inorganic phosphorus 3.6 milligrams; the calcium 10.8 milligrams; and the cholesterol 214.2 milligrams. The Kahn test was negative.

A basal metabolic test was technically satisfactory, the result being plus 8 percent.

COMMENT

Investigation of the possible causes of this condition does not disclose any factor which can definitely be implicated. The only possibility is the anxiety state. The exact mechanism here is not clear, but it is assumed that such specific changes could be effected through the autonomic nervous system. The way one's "hair stands on end" during fright or excitement is an example of how this mechanism is put into action. However there is no mention in textbooks of the occurrence of cases of alopecia as a result of psychiatric factors. There is no specific therapy.

A possible relationship between the anxiety state in this case and the clinical condition is suggested.

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PENICILLIN LOCALLY

Penicillin has several properties that make it of distinct value as an antibacterial agent for local application: (1) It is active against most of the organisms responsible for serious local infections; (2) it is active in high dilutions; (3) it is not inhibited by exudates and is nontoxic either locally or generally.

Of 95 cases of various types of infections treated with crude penicillin locally, the results were good in 63 percent, indefinite in 24 percent, and poor in 13 percent. The lesions which have shown the best response are the more acute or subacute ones in which the bacteria are superficial, or chronic ones following surgical drainage with removal of all dead tissue. Local penicillin therapy is not recommended to the exclusion of other methods of dealing with infections.—FISCHER, A. M.: Therapeutic value of penicillin applied locally, based on experience with crude material in variety of infections. *Bull. Johns Hopkins Hosp.* 76: 134-153, March 1945.

FOREIGN BODY IN THIGH

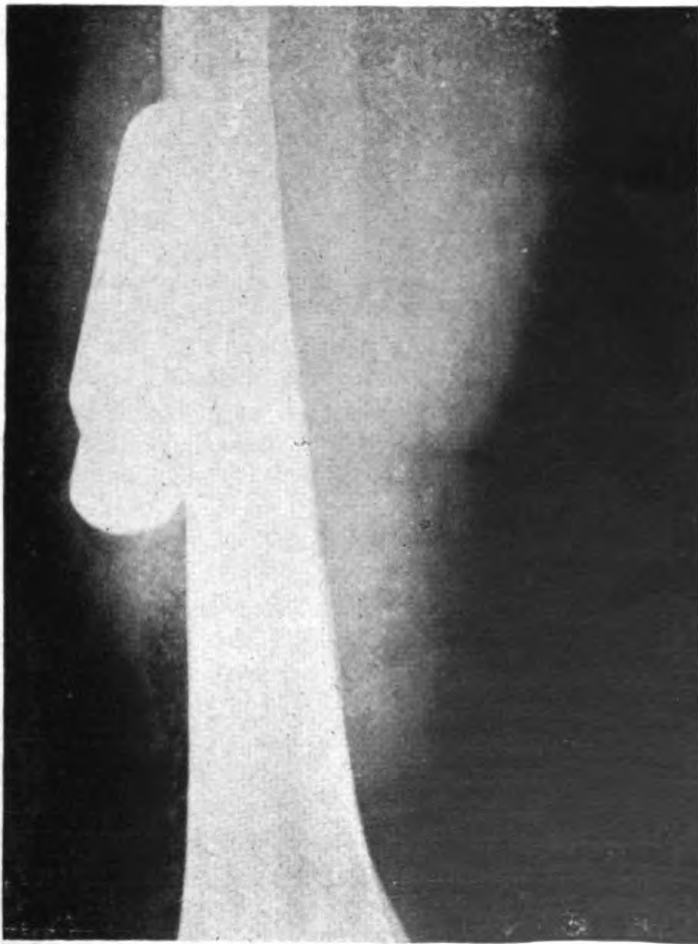
REPORT OF A CASE

HAROLD LUSSKIN

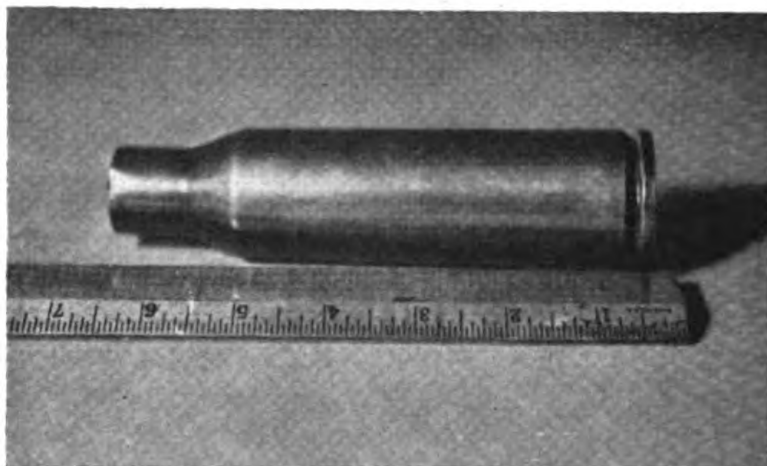
Lieutenant Commander (MC) U.S.N.R.

Freakish accidents caused by shells and firearms are not rare. Many of these cases, however, have been fatal. In the following case a large shell case $6\frac{3}{8}$ by $1\frac{11}{16}$ inches, the primer unexploded, was driven completely into the thigh, fracturing the femur. It was removed and recovery was uneventful.

Case report.—A chief gunner's mate was admitted to the hospital ship on 18 June 1944 with the following story. A seaman had picked up a Japanese 25-caliber shell with projectile intact. In order to remove the projectile he



1. X-ray film of the left thigh showing a large shell case, a punched-out area on the outer side of the midfemur, and an oblique fracture of the femur.



2. Photograph of the shell case measuring $6\frac{3}{4}$ by $1\frac{1}{4}$ inches. The primer was found unexploded.

fastened it on a vise, leaving the case extending beyond the clamp. He then attempted to bore a hole in the projectile with a drill. The patient saw this, ran into the room, drove away another seaman present, and yelled for the operator to stop. Just as he was crossing the room, the heat generated by the drill exploded the powder in the shell case, driving the case backward, embedding itself in his left thigh.

The patient was found sitting on a bench unable to move. He complained of only moderate pain. A Thomas splint was applied and he was sent to this ship.

Examination showed him to be apparently fairly comfortable, not in shock, and in moderate pain. Marked swelling was noted in the left thigh, with a round skin defect anteriorly, about 2 inches in diameter, in the midthigh. There was very little bleeding. A firm mass could be felt posteriorly just below the gluteal fold. Where this hard mass was close to the skin, there was bluish discoloration. The femur seemed to be fractured. Motion of the legs was painful. Some crepitation was felt in the midthigh.

X-ray examination showed the entire shell casing within the thigh, lying against the outer part of the femur. A long oblique fracture was present in the midfemur (fig. 1).

In the operating room the anterior wound was cleaned. On inserting the finger into the skin defect, the front edge of the shell casing with muscle tissue packed into it, could be felt. The brass case with unexploded primer was removed. It measured $6\frac{3}{4}$ inches long and $1\frac{1}{4}$ inches in diameter at the base (fig. 2). The wound was cleaned, debrided and 5 gm. of sulfanilamide was sprinkled into its entire length. At the site of the bluish discoloration posteriorly a $1\frac{1}{2}$ -inch incision was made and a patch of dungaree and piece of skin 2 inches in diameter, which had been punched out of the patient's trousers and thigh by the shell case, were removed. This wound was also sprinkled with sulfanilamide. Vaseline gauze was lightly packed into each wound. Steinmann pins were then inserted in the femur, and a plaster cast was applied. Tetanus and gas antitoxins were given. Roentgenograms showed a satisfactory reduction of the fracture.

MEDICAL AND SURGICAL DEVICES

NEW ATRAUMATIC EXODONTIA INSTRUMENT

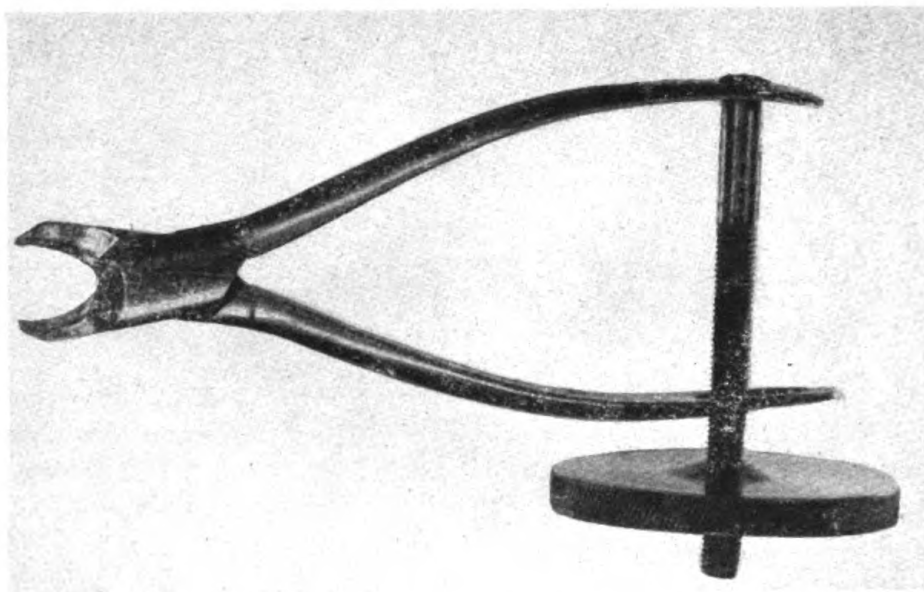
ALBERT DAVID ALEXANDER
Lieutenant Commander (DC) U.S.N.R.

Tooth sectioning is a decided advantage over bone sectioning in the removal of impacted teeth. It conserves the vital tissue necessary for repair, shortens the period of recovery, and lessens post-operative pain. The procedure is easily tolerated by the patient, and the operation simply accomplished. The illustrated tooth-splitting forceps is designed for the purpose of facilitating the operation with the application of a reciprocal crushing pressure principle, which permits sensitive control by the operator. It has chisel-like beaks strong enough to withstand this force.

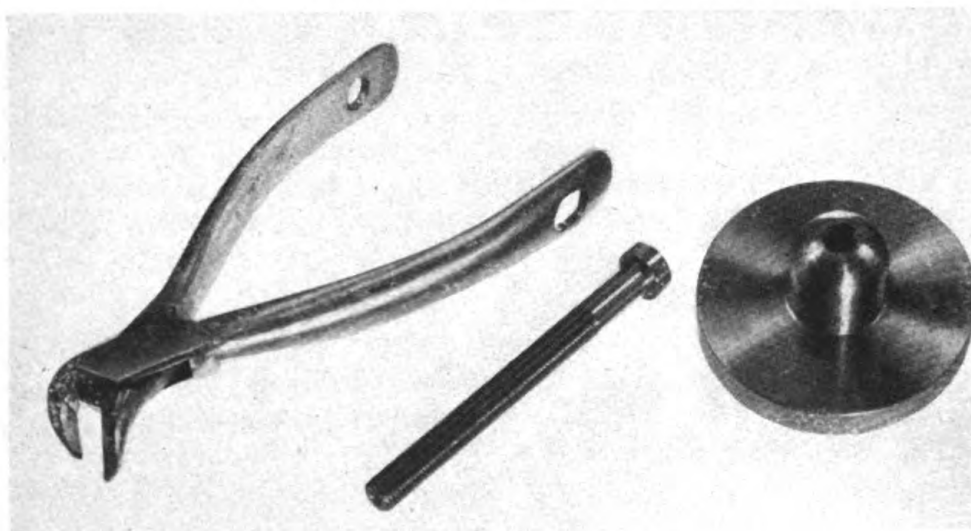
The control and gradual application of pressure is attained by means of a knurled revolving wheel, threaded to match a bolt which is fixed to one handle. Only slight turning is required to exert a considerable force delivered at the beaks of the forceps. This reciprocal force applied to two points on the tooth simultaneously avoids traumatizing the investing tissue. If sufficient pressure is brought to bear upon these two opposing points a snapping cleavage results. The tooth is split in the line of the applied chisel-like beaks which are under the constant finger-tip control of the operator.

Difficulties of access and of obtaining the desired angle are disadvantages of the use of the bur under these circumstances. Moreover the debris of tooth filings obscures the operative field, and contaminates the socket after delivery of the tooth. The procedure of cutting through a tooth with a bur is anything but a short one. Heat is generated and there is a constant danger of slipping and mutilating the surrounding soft tissue. Abrasive disks and stones obviate to some extent these objectionable features. These methods, however, present the difficulty of handling a rapidly revolving cutting tool in an area where vision is difficult and space limited.

A malleted chisel, on the other hand, eliminates debris, reduces heat generation, lessens the danger from the use of a revolving



1. New atraumatic exodontia instrument.



2. Instrument disassembled.

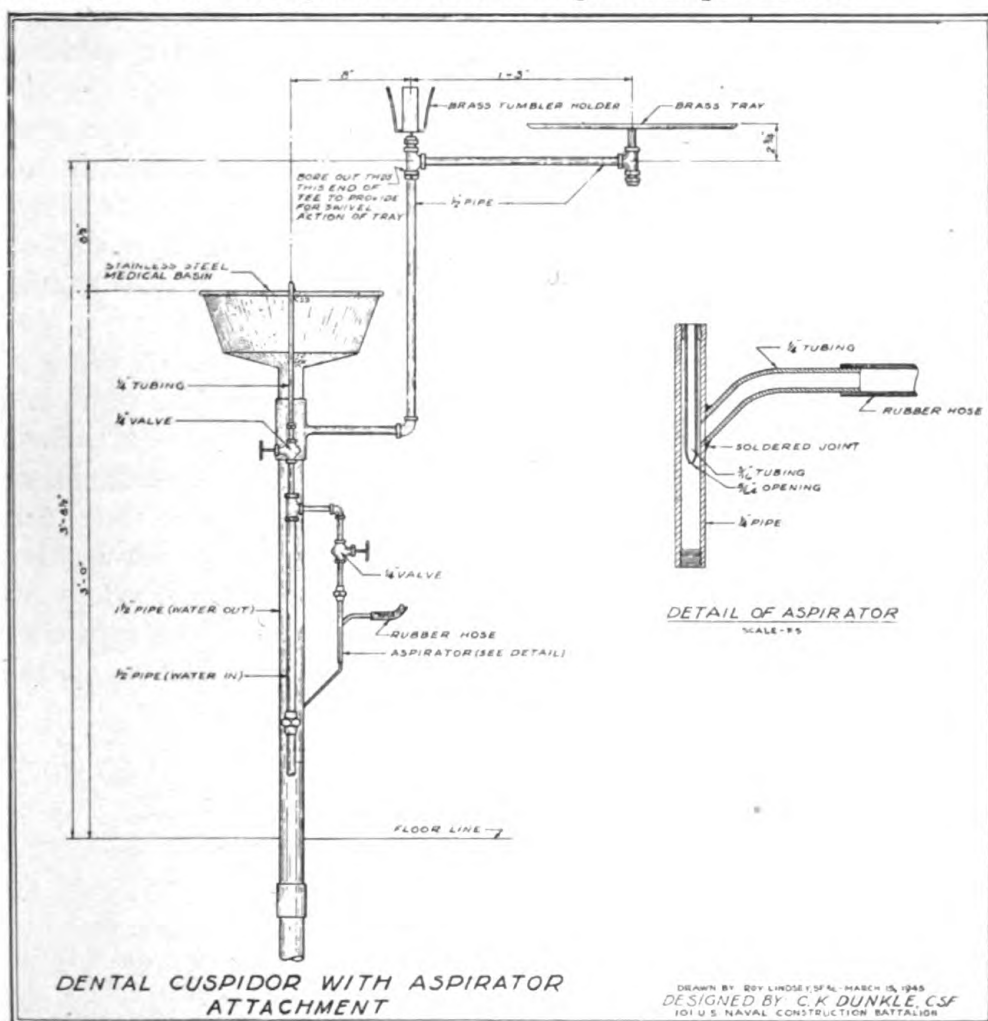
tool in a small operative field, and greatly shortens the operating time. But it introduces two new factors, trauma and lack of control. The exact force of the blow necessary to fracture the tooth cannot be estimated prior to operation, nor can the line of force be controlled. To overcome these objections, the automatic chisel was designed, by means of which any desired blow could be duplicated and applied at will but not without causing trauma.

All of these undesirable points are eliminated by the author's tooth-splitting forceps wherever it can be used. It fulfills all the requirements previously mentioned and requires no special training.

IMPROVISED DENTAL CUSPIDOR AND ASPIRATOR

JOHN T. McSWEENEY
Lieutenant (DC) U.S.N.R.
and
CHARLES K. DUNKLE
Chief Shipfitter U.S.N.R.

A good saliva ejector or aspirator is the single instrument most frequently lacking in a dental field unit. In order to supplement equipment where one is missing, and to provide plans and specifications, the following construction diagram is presented.



Procedure for construction.—The top of an ordinary issue stainless steel basin turned or rolled at its periphery to form a track

for flushing water is utilized; if an issue basin is not available a similar one is easily constructed by any plumber or tinsmith. The basin is soldered to a section of $1\frac{1}{4}$ - or $1\frac{1}{2}$ -inch pipe, a hole having been made to conform to the size of the pipe. The pipe is previously reamed at the upper end and threaded at the lower. A reducing tee with the threads filed or reamed in its trunk or vertical aspect is then slipped over the waste or drainage pipe and secured at the desired height for supporting the bracket table or instrument tray arm.

The water lines are cut and assembled. The aspirator attachment is fashioned from a $\frac{1}{4}$ - by 4-inch nipple by tapping out both ends. A hole just large enough to receive a $\frac{1}{4}$ -inch tubing is drilled in the side of the nipple. A bushing wrought from a piece of $\frac{1}{8}$ -inch pipe or solid rod and a section of $\frac{3}{16}$ -inch tubing, long enough to extend beyond the branch of the Y joint are soldered into one end. In the other end of the bushing a screwdriver slot is put to facilitate removal for cleaning. This jet is the most important part of the assembly and care must be exercised in following the specifications. The tubing is then drawn or constricted to a point into which an aperture $\frac{5}{64}$ inch in diameter is drilled.

Finally the suction tube is soldered to the side of the nipple, completing the assembling of the aspirator, and the water-piping system is secured to the main supporting drain pipe. A piece of copper tubing bent to provide the rinsing stream for the bowl and a second tube made to run to the tumbler if desired are attached.

The accessories made from brass or other suitable material or even borrowed from the standard field unit and fitted into this outfit, include bracket table or instrument tray, tumbler holder, and their accompanying supporting structures. These when attached complete the unit. It is well to remember that the aspirator may prove useful for suction in surgical cases as well as in the dental office.



WHAT'S IN A WORD

Joseph Conrad once said, "A word carries far—very far—deals destruction through time as the bullets go flying through space." Medicine has a few such words. Too often these are used when a serious or potentially serious condition must be explained to an apprehensive patient. When words treacherously lull either the patient or the physician into a false sense of security, then words may ultimately maim or destroy as surely as if they were bullets.—EDITORIAL COMMENT: Tuberculosis abstracts. Rocky Mountain M. J. 42: 292-294, April 1945.

TABLE FOR DENTAL PHOTOGRAPHY

JOHN W. RICHTER
Lieutenant (DC) U.S.N.R.

A sturdily constructed table of sufficient width serves efficiently for dental photography.



This device has taken the place of a tripod which proved cumbersome, and the bracket-table because it cannot be fixed and made rigid after focusing.

A number of advantages¹ accrue if both the camera and lights are mounted on one stand, and the small space occupied by the camera stand permits use of the table for the dental instruments. The dental officer therefore is able to work with only slight interruption during the photographic procedure.

¹ RICHTER, J. W.: Maxillofacial kodachrome photography. U. S. Nav. M. Bull. 43: 495-501, September 1944.

PRACTICAL WALKING SLIPPER FOR PLASTER CAST

DAYTON O'DONNELL
Lieutenant Commander (MC) U.S.N.R.

In the South Pacific the problem of securing proper metal for making a walking iron to be incorporated in an unpadded plaster-of-paris cast is usually difficult.

The illustrated walking slipper has been used satisfactorily at

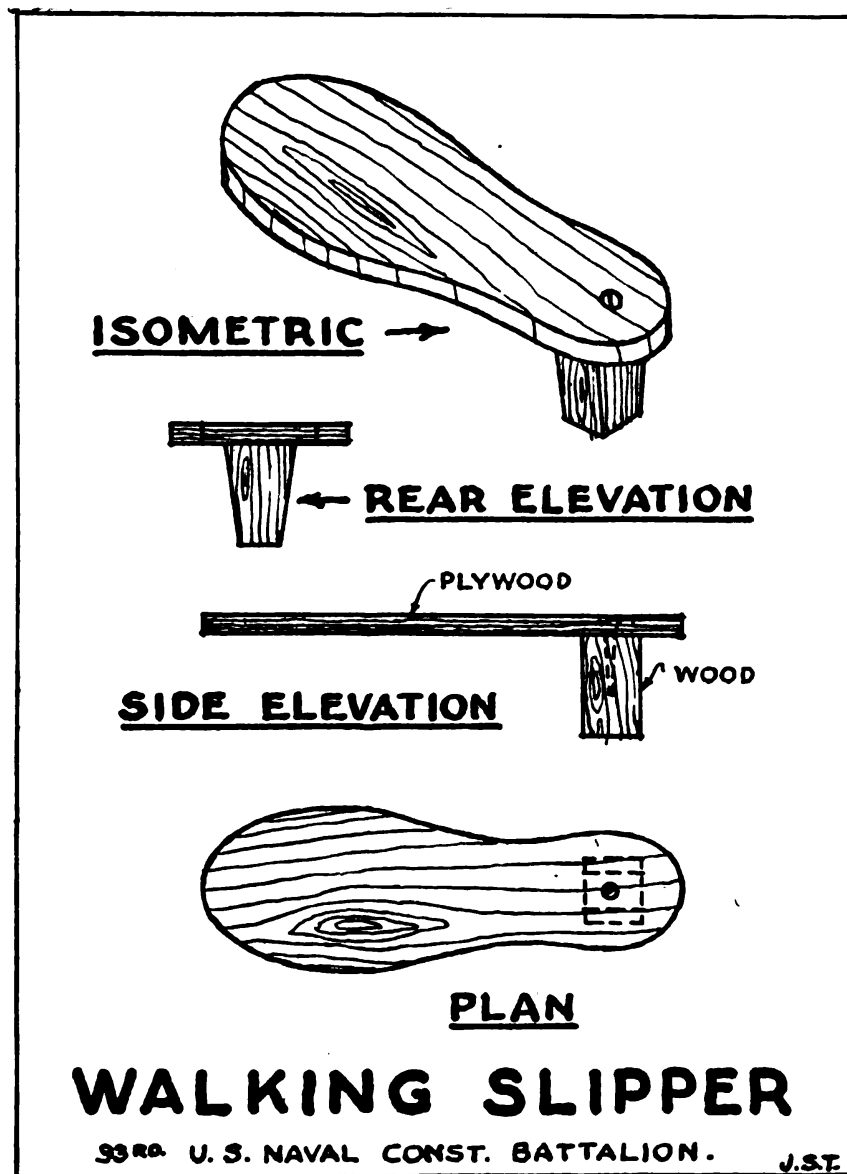


Figure 1.



2. Slipper incorporated in cast.

this activity.

The slipper is applied next to the posterior plaster splint and is fastened to the foot by several turns of plaster around the heel and sole.

The patient should not bear weight upon the walking slipper for at least 48 hours and during that time the cast should be held under a drying tent.

The walking slipper is simple, easy to make, and experience has proved it serviceable.



RED CELL VOLUME IN SEVERELY BURNED PATIENTS

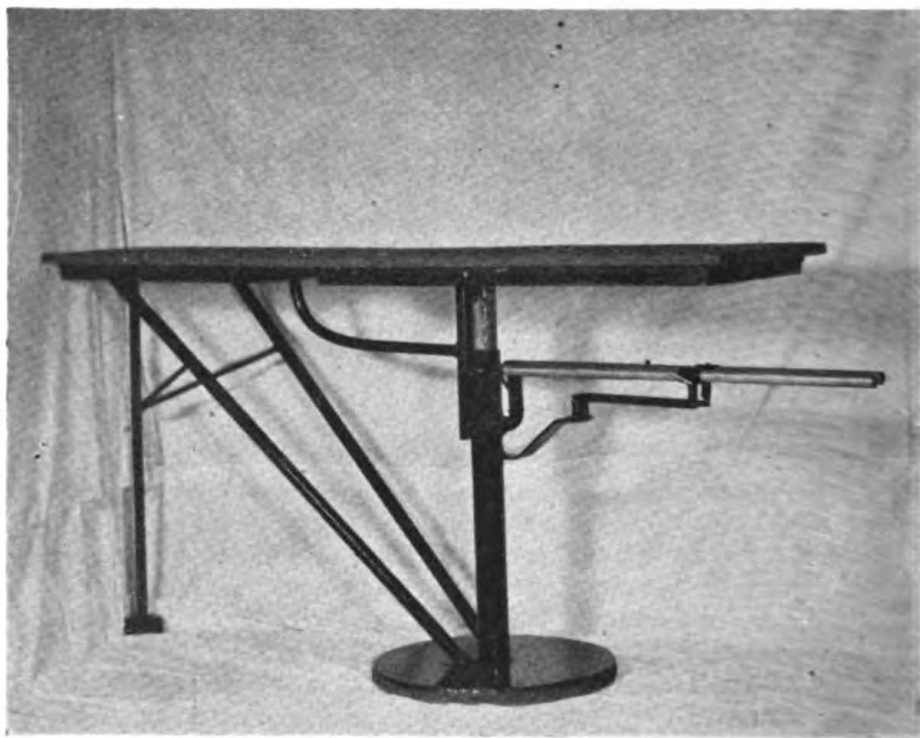
From about the sixth day to the tenth or twelfth day, the severely burned patient shows a progressive hemodilution with respect to red cells, and a progressive loss of total circulating red cell volume. The loss of red cell volume per day may be as high as 200 cubic centimeters. It is clear that during this period whole blood or red cell suspensions should form a part of therapy. From the fourteenth day, the patient gradually restores his relations to normal, decreasing the amount of fluid in the interstitial department, increasing his total circulating red cell mass, and bringing the plasma protein concentration to normal.—MOORE, F. D., and COPE, O.: Fluid and protein shifts in severely burned patients. *Bull. Am. Coll. Surgeons* 30: 65, February 1945.

SHIP-MADE ORTHOPEDIC TABLE

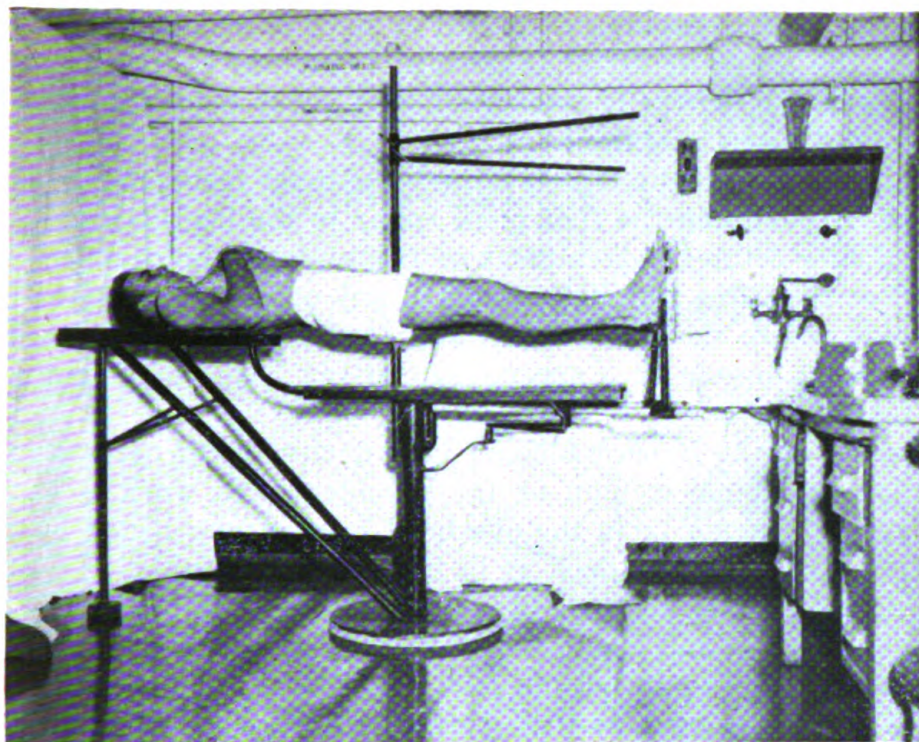
EUGENE L. JEWETT
Commander (MC) U.S.N.R.

The illustrated homemade table was constructed by shipfitters out of miscellaneous pipes and other supplies aboard ship. It was placed in a small room near the standard orthopedic table, thus permitting the orthopedic team to use one table while the other was being made ready for another patient. A few minutes setting often prevents a cast from subsequently breaking. With no increase in personnel, the volume of work accomplished by the two-table system was doubled and there was less confusion and interruption between patients. Furthermore, with a top pad, this table may be converted into a good general operating table weighing about 90 pounds, which is fairly easily moved.

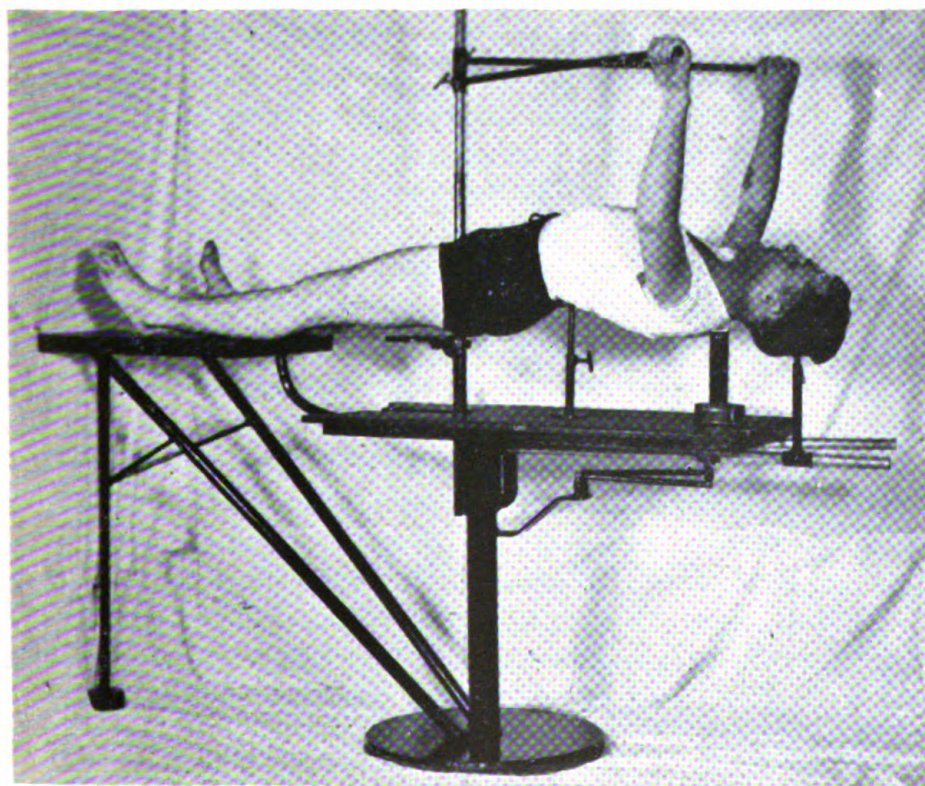
Among the noteworthy features about the table is the ample space between the leg pieces and the deck, allowing easy and complete fluoroscopic control for fracture work of the extremities.



1. Table with rubber pad for use as a general operating unit.



2. Table rigged for lower extremity work.



3. Patient on back assembly helping to support himself by the overhead bars.

After the patient needing a leg cast or spica is fastened to the foot plates, the lower or distal table top is dropped by pulling out a large lock pin, which is reinserted in a lower hole when the desired free space is obtained.

The traction on the legs is done by manual force and is maintained by clamping the foot piece collar to the leg piece bar.

A Böhler setup for treatment of fractures of the os calcis, and used for fractures and dislocations of any of the bones of the foot or ankle where skeletal traction and countertraction is needed, is obtained by means of a special supporting bar attachment near the foot of the table.

Instead of the hyperextension jack device in the treatment of a fractured spinal column or for shoulder spica work, a canvas belt could be slung from the overhead bars, strengthened by supporting bars from the deck as in the os calcis setup.

This table could be made of a light, strong alloy with an x-ray translucent top and made demountable for carrying in one or two cases. The main bottom part could be a hollow cylinder or box with the top open so that it may be filled with sand, rocks or pieces of metal for stability when assembled. The rubber on both bases prevents sliding and tends to reduce vibration, although it would be easy to bolt or weld to the deck.

EDITORIALS

CELLULAR ASPECT OF IMMUNITY

Modern immunology is based upon an antigen-antibody phenomenon. An organism survives infection because antigenic stimulation is sufficient to elicit a good antibody response.

Considerable controversy, however, has recently arisen over the tissues responsible for antibody formation. For years it has been almost universally accepted that the reticuloendothelial system was the one most concerned. Undoubtedly this is founded on the phagocytic property of the cells of this system, and because they are in the best physical position for antigenic stimulation. However there is only indirect evidence in support of antibody production by these cells. The phagocytic and digestive functions of macrophages as well as those of polymorphonuclear neutrophilic leukocytes are unquestioned but phagocytosis of formed antigens does not necessarily imply the production of antibodies.

The "blockade" experiment and the shedding of cytoplasm upon which this premise is based admit other interpretation.¹ The depression of antibodies through blockage of the reticuloendothelium with phagocytic material may mean among other things that this cell while engaged in digesting one inoculum cannot well take care of a second at that time, and therefore the antibodies of this second substance just are not produced. On the other hand ingestion of dye-protein aggregate and the shedding of cytoplasm coincident with the time when the dye-protein is no longer visible in the cell and antibodies are found in the serum may mean nothing more than phagocytosis with probable splitting of raw material and expulsion of a precipitate or of an early cell-degeneration product. The shedding phenomenon is nothing peculiar to macrophages; lymphocytes equally share this property.

From a practical viewpoint, because of the increase in neutrophilic leukocytes in a blood smear during an acute infection and preponderance of lymphocytes in a subsiding or chronic process, it is assumed that antibody production is the function of phago-

¹ EHRLICH, W. E., and HARRIS, T. N.: Site of antibody formation. *Science* 101: 28-31, January 12, 1945.

cytic cells. Furthermore it is known that lymphocytes do not phagocytize but take up only dissolved material. For these reasons therefore they have been regarded as of little significance in immune response.

Bunting,² however, first disputed this conclusion, demonstrating that lymphocytes are important in the defense against toxin and soluble antigens. These substances once gaining access into the body are readily taken up by the lymph and conveyed to the regional lymph nodes where their disposition is effected.

Ehrich and Harris have shown that the cellular response within the lymph node during antibody formation is chiefly lymphocytic and that lymphocytes in the efferent lymph vessels of the popliteal node of rabbits contain antibodies in much higher concentration than the surrounding lymph.

Moreover the destruction of lymphocytes by x-ray produces a reduction in antibody, whereas an increase is induced by stimulation with dry heat. On the other hand it is inferential at least that the enlargement of regional lymph nodes in infection is for some other purpose than a mere production of blood lymphocytes.

These observations rather cogently reveal a lymphocytic part in the production of antibodies, a role which has been denied these cells up to the present time.

The specific immune response of an animal is greatest when the antigenic stimulation is widespread. It is accepted that the specific activity of immune serum is a function of globulin molecules; the surface of each has been modified so that it is specifically adapted to unite with that of the corresponding antigen. Hence probably any normally metabolizing body cell which produces globulin is potentially a source of antibody. Cells of the reticulo-endothelial system, however, are credited with the largest share of antibody-forming function, but in the light of the present review, not to the exclusion of other cells of the body, particularly lymphocytes.

² BUNTING, C. H.: Cell reactions in resistance and immunity. Wisconsin M. J. 24: 305-311, November 1925.

HERNIA STATISTICS IN THE NAVY

The plea for a more thorough follow-up study of hernial cases, as suggested elsewhere in this BULLETIN, p. 221, is worthy of general consideration.

According to the most recent Selective Service figures, hernia ranks sixth in cause for rejection from the armed services, whereas in the Navy the number of admissions to the sick list for hernia during 1944 was 16,386; in the same interval 1,114 patients were admitted with the diagnosis of recurrent hernia, 484 of whom had their recurrences prior to their entrance.

From this data it is apparent that the Navy offers an excellent opportunity for statistical studies of the hernial problem. However the difficulties involved in a program of this type are most complex even with a relatively simple problem such as hernia.

In the first place agreement must be had upon the various determinants to be processed. Assuming that the major points of interest about hernia are those which Timmes has indicated, the evaluation of the success of a particular type of operation necessitates uniformity of surgical procedure which varies as distinctly as the individual surgeon. The fact that an operation is designated as done according to the Bassini, Ferguson, or Halsted technic has limited statistical value. Operative procedures are not stereotyped. Every surgeon instinctively carries through with his own personal modification even in an ideally adaptable case, the modifications depending equally upon the knowledge, ability and training of the surgeon as well as upon the presenting pathologic anatomy.

Frequently the so-called classic operation is given the blame for failure when in fact the surgeon's modification violated a principle of physiologic dynamics.

Each surgeon consequently must rely upon his own series of operative cases and must stand by the percentage of successes or failures. Obviously a contribution of this type admits too many variables and can give at best only general information concerning the relative value of the different operative procedures for the repair of hernia.

Until the surgical anatomy of the inguinal region and the physiology of the constituent parts are agreed upon and their relative values in the production and repair of hernia are assessed, no uniformity of surgical procedure can be forthcoming. Brandon¹ in a most interesting analogy calls attention to this phase of the hernial problem. Making a plea for a review of fundamentals, he

¹ BRANDON, W. J. M.: Inguinal hernia, the house that Bassini built. *Lancet* 1: 10, February 10, 1945. Cited in U. S. Nav. M. Bull. 44: 1238, June 1945.

affirms that if a house persists in falling down in spite of having immensely strong walls, it can only mean that no one has examined the foundations with sufficient care.

The presence and disposition of a sac, the type of suture material employed, early ambulation of the patient, and the many complications incident to a major operation are secondary problems, and their effect on recurrence may be contributory but unessential in the evaluation of the principles underlying the various types of hernial repair.

Finally it is not always possible at a second operation to determine what type of procedure was originally employed. The matting of scar tissue frequently necessitates radical dissection to reach the pathologic anatomy, making it difficult to state categorically what specific type of operation and its various modifications was primarily employed.

It is apparent from these considerations that over-all Naval statistics can give at best only a general appraisal of the hernia problem. Before some practical results may be forthcoming from an evaluation of this or any other specific surgical program, a more exacting, uniform and fundamental surgical approach must be determined.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,

Bureau of Medicine and Surgery, Navy Department,

Washington 25, D. C.

(For review)

THE VETERAN COMES BACK, by Willard Waller, Associate Professor of Sociology at Barnard College, Columbia University. 316 pages. The Dryden Press, New York, publishers, 1944. Price \$2.75.

Among the flood of writings on veterans' problems, the prejudice must be separated from the fact, the verbiage from the idea, and in the final coordination much will be gained, and something preserved, from each different point of view presented. It can rarely be said that any one is entirely right or utterly wrong. In rehabilitation America is an amateur; we have, to be sure, the experience of bungling the problem of World War I, and we are feeling our way more cautiously this time, but our groping efforts need all the help we can get.

Medical men have (it is hoped) read about and studied the problem from the medical and psychiatric aspect. The well-rounded point of view, to mix a metaphor, would include social, economic and political aspects also; and need it be pointed out that these aspects are interrelated?

In "The Veteran Comes Back" a sociologist attacks the problem—and with vehemence—so much vehemence that you will often disagree with him violently. And thus he succeeds in one of his patent purposes, the changing of passive sympathy to frightened desire for action. Should we be afraid of the veteran as a political force, or for that matter as a social problem and as a family man? The author poses the question in ominous terms and with plenty of historical background, drawing heavily on the experiences of World War I and its postwar maladjustment.

The flamboyant use of newspaper headline style and typography in the chapter heads sets the tone, although not the pace,

of the subject matter. Whether the author must, as the professor, begin at the beginning, or whether he purposed to establish his theme from veterans of ages past, including Odysseus "who returned from Troy to make counterrevolution in Ithaca," through the terrors of the Ku Klux Klan in this country, to the rise of Fascism and Naziism by "veterans' anger, the principal organizing force in society," the historical introduction is both thought-provoking and menacing, with its reiteration of the theme of counterrevolution.

Veterans are treated as a whole; no distinction is made between the able-bodied and the disabled. If historically accurate, it is enlightening. What of the effect of such a book? This reviewer would not presume to say. It must be read with understanding and tolerance, lest antagonism to the writer obscure sympathy for the problem. The book is gripping in spots, scathing in spots. Especially assailed are those descendants of the "swivel-chair heroes" who, in the case of the Navy, "have never missed a meal or a night of sleeping with their wives, yet who have become very salty in their language and . . . welcome their guests of the evening by saying 'I'm very glad you are aboard tonight.'"

This reviewer believes that there has been enough of "awakening us to the problem" and that there is a plethora of nonsense written about the returning veterans who are sound and whole and some who are not whole. Already the veteran as "motherless child" coming back to "an alien homeland" with a "core of anger in his soul" (Chapter 2) palls upon a public to whom some individual veteran is not a totally strange, unadjusted being, with a soul filled with bitterness. The graveness of the problem must never be denied, nor should it be dinned less raucously into a stolid public consciousness, but care must be taken not to distort the picture, inflicting thereby maladjustment where it does not exist.

These radicalisms, however, should not prejudice against a good deal of sound, common sense to be found in the book and a lot of background material that is necessary to intelligent study of a problem, the many solutions of which only time can appraise. We have, as the author points out, "accumulated a considerable body of past experience from which we must not neglect to draw the proper lessons . . ." The problem of the returning veteran, in this reviewer's opinion, is of longer range than has yet been touched upon; it is essentially not a problem of the *returning* veteran but of the *returned* veteran some years hence, when all the fanfare of the veterans' coming back and the first flush of patriotism and of prosperity have died down.

PHYSIOLOGY IN HEALTH AND DISEASE, by *Carl J. Wiggers, M.D., D.Sc., F.A.C.P., Professor of Physiology and Director of Physiology Department in the School of Medicine of Western Reserve University, Cleveland, Ohio.* 4th edition, thoroughly revised. 1174 pages; illustrated with 247 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1944. Price \$10.

Wiggers' textbook of physiology, published in the latter part of 1944, is the most recent edition of a leading work on physiology. Already it has had a wide acceptance; justly so since it offers a well-balanced condensation of all the important newer work except that which is still confidential. It may well remain a standard until after the war, when the sudden release of a great mass of first rate physiologic studies will make it necessary to revise every textbook.

Carl J. Wiggers is one of the few men in this country able to write a whole textbook of physiology. He has been teaching the subject since 1906 and his research has made him the leader in the field of hemodynamics. The literature that he has covered has been well selected and is of enormous extent; for example, over 1,000 new references have been added to this fourth edition. The book has been written from the standpoint of a man primarily interested in teaching physiology but keenly aware of the clinical and military applications. Naturally his chapters on the circulation are the most authoritative. No one physiologist can work in all the branches of the subject and it is evident that some of the chapters are mainly compilations from the literature. The book, however, has the advantage of having been put together by one man. This gives it better integration and balance than a textbook written by a group of authors.

The fourth edition of Wiggers contains 1,174 pages, only a few more than his third edition. It is not nearly as bulky as the Best and Taylor third edition, 1,942 pages (Williams & Wilkins 1943), and it is about 2 pounds lighter than the ninth edition of the Macleod-Bard textbook by 10 authors (C. V. Mosby 1941). The publisher has provided a paper of good thickness without glaze and a type that makes reading fairly easy. The author's style, like that of most American scientific writers, is clear and accurate but shows an effort toward condensation. It makes one wish that our authors could capture the ease and charm that characterize so many of the English and Canadians.

The main purpose of the book is to serve as a text for medical students, and it probably is the best available this year. There is a proper emphasis on the science of physiology itself, showing its foundations on the laws of physics and chemistry. There is also an excellent use of clinical examples as illustrations of the principles of physiology and of their practical applications. This

fourth edition adds a great deal of material relating to war physiology.

For practitioners the work will be valuable chiefly as a book of reference, read in connection with clinical literature or as an aid in the diagnosis and treatment of difficult cases. Indeed all practitioners should force themselves to read through a textbook of physiology every five or six years, since the advances are so rapid that it is not safe to base one's knowledge on a physiology of an older vintage. Wiggers' book provides an adequate physiologic basis for use of the clinician, but does not contain the long and excellent discussions of disease that make the Best and Taylor physiology a good textbook of medicine. It does not have as great an emphasis on biochemistry as Best and Taylor and the chapters on neurophysiology and respiration do not carry the weight of authority that characterized the Macleod-Bard discussions in 1941. Nevertheless they are good and are up to date.

The clinician who is preparing a paper on any medical subject will be wise if he makes a thorough study of the pertinent chapters in this edition. It will bring him up to 1944, particularly if he makes use of the large number of well selected references.

There are the usual typographic errors and mistakes in references and it is to be expected that these will be corrected in the next reprinting. Some physiologists will object to a retention of the older use of the word irritability to connote in some places excitability and in others contractility. It is unfortunate that the older word secretion is used so frequently in regard to the kidney, when emphasis should be placed on excretion.

The book is conveniently divided into 67 short chapters. About one-quarter of the pages are given to the heart and circulation, but this is to be expected from an author who has devoted most of his research to this field. In contrast only 37 pages are allotted to the special senses. As in most textbooks the physiology of the skin as an organ is hardly given the dignity of even a paragraph to itself.

The chapters that are particularly well handled are those on coronary circulation, hypertension, water balance, and blood substitutes. All of these are of importance to the clinician. The chapters on metabolism are rather brief. In the opinion of the reviewer there is too much support of those authors who warn of the dangers of high protein diet, and too much emphasis on the possible conversion of fat into carbohydrate.

The medical officers in the armed services will find that this fourth edition has been revised particularly with their needs in view. The chapter on aviation medicine is brief but comprehen-

sive. That on respiration is good and carries the latest word about Roughton's work, which helps to clear the disputes regarding the tension of oxygen in the alveolar air. The discussions of muscular work, training and fitness are important for field activities. The chapter on heat loss and temperature control is brief but clear, far better than corresponding chapters in most of the other textbooks.

This 1944 edition of Wiggers should be available to every military surgeon, it should be read and what is more important, it should be studied. It is not easy reading but there is no easy way to keep up to date in physiology, the basis of clinical medicine.

THE PATHOLOGY OF INTERNAL DISEASES, by William Boyd, M.D., LL.D., M.R.C.P., Ed., F.R.C.P., Lond., Dipl., Psych., F.R.S.C., Professor of Pathology and Bacteriology in the University of Toronto. 4th edition, thoroughly revised. 857 pages; illustrated with 366 engravings and 8 colored plates. Lea & Febiger, Philadelphia, Pa., publishers, 1944. Price \$10.

Professor Boyd, through his rare choice of words, has presented a combination text and reference book to the internist as well as to the pathologist, which is a pleasure to read.

The presentation of the material is based on pathology and its relation to the symptoms of disease. This fundamental approach, directed toward describing the mechanism of man's ills, enables the reader more clearly to interpret and evaluate symptoms.

To quote from the preface of the first edition "A sound understanding of pathological processes will endow the physician with a roentgen-ray vision, so that the coverings of the body are rolled away and the hidden processes of disease stand revealed." This is particularly true when the pathogenesis of disease is considered in the light of biochemistry, pathologic physiology and allied sciences.

The fourth edition still maintains the charm of the classics of early medicine, modernized and added to in accordance with the latest trend of medical literature. Thus we are made cognizant of changes in concept as well as the revelations of scientific research.

The sections on diseases of the kidney and the liver are particularly delightful to read, whereas the section on tuberculosis of the lung, though very complete, is somewhat difficult to wade through.

In the opinion of the reviewer, this book should be in the hands of every medical man because of its comprehensive approach to the subject and its charm of rendition. Each specialist as well as general practitioner will be able more readily to interpret his findings in the light of basic scientific reasoning.

LEUKOPENIA AND AGRANULOCYTOSIS, by *William Dameshek, M.D., Clinical Professor of Medicine, Tufts College Medical School; edited by Henry A. Christian, A.M., M.D., LL.D., Sc.D. (Hon.), F.A.C.P., Hon. F.R.C.P. (Can.), Hersey Professor of the Theory and Practice of Physic, Emeritus, Harvard University.* Reprinted from Oxford Loose-Leaf Medicine with the same page numbers as in that work. Oxford University Press, New York, publishers, 1944. Price \$1.75.

This small volume (less than 100 pages) fulfills the promise of its preface; it is a compact but comprehensive treatise on leukopenia and agranulocytosis. Both conditions occur not infrequently as toxic manifestations of sulfonamide therapy. Knowledge and understanding of the subjects of this monograph are therefore of great importance for the practising physician.

The classification of leukopenia, with particular reference to etiologic factors, is thorough and gives an excellent basis for the differential diagnosis of conditions causing a scarcity of leukocytes in the peripheral blood. It is out of the scope of the author's treatise to give a detailed account of each of the diseases causing leukopenia. Consequently this section of the book carries but few case reports to point up briefly the pertinent data for the physician whose background in hematology is not especially lush. The discussion of symptomatic splenic leukopenia is in greater detail and is particularly good.

A more condensed yet easily read study of agranulocytosis, and a better review of the literature on the subject could scarcely be found. The physiopathologic mechanisms are presented so clearly that the steps in the evolution of the disorder can be thoroughly appreciated. Much consideration is given to therapy, reported as far from satisfactory, despite occasional short-lived use of some drug which claims to reduce mortality to 30 to 50 percent. Dameshek states that the fatality in this disease is about 80 to 90 percent, and asserts that death is not due to granulocytopenia per se but to bacterial invasion in a body stripped of its normal leukocytic defense. Emphasis is placed, therefore, upon combating sepsis (with one of the sulfonamides, preferably sulfathiazole, or penicillin) as the most important factor after discontinuance of the sensitizing drugs. Yet when faced with a disease of such violent intensity as agranulocytosis, Dameshek feels that one is justified in using any measure possibly offering a contribution to recovery. These additional methods which he considers are x-ray therapy over the long bones, nucleic acid derivatives including pentose nucleotides and adenine sulfate, transfusions of blood, leukocytic cream, liver extract, and foreign proteins.

THE ART OF ANAESTHESIA, by *Paluel J. Flagg, M.D., Visiting Anesthetist to Manhattan Eye and Ear Hospital; Consulting Anesthetist to St. Vincent's*

Hospital, New York, N. Y. 7th edition. 519 pages; 166 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1944. Price \$6.

The preeminent place that Dr. Flagg has attained in the field of anesthesia is a guarantee that anyone interested in this specialty will not fail to derive much of value from the author's latest revision of this work, which was first published in 1916.

The volume is organized in two parts. In the first the author gives a brief historical résumé of the subject, then proceeds to discuss anesthesia under the three main classifications: General anesthesia, local anesthesia and regional block. Part two covers factors incidental to the actual administration of the anesthetic, and newer agents and methods. The section on general anesthesia is introduced by a chapter entitled "The Detailed Consideration of a Complete General Anesthesia," which to this reviewer seems confusing in the material presented, and which he feels would be difficult of interpretation by a neophyte. This is followed by a good elucidation of the classic signs of general anesthesia, and subsequent chapters deal with the classic agents of general anesthesia: Ether, chloroform, nitrous oxide, ethylene, and ethyl chloride. The proper handling of these agents of general anesthesia is most carefully presented by the author, and it is from these chapters that the reader will derive the real value of the book. The author gives a detailed description of the use of ether, and rightly emphasizes its position in first place as the most useful, trusted and safest of all the general anesthetics. He discusses chloroform chiefly to condemn its use and to stress its dangers; he gives a most helpful, detailed presentation of the proper handling of nitrous oxide, as a general agent per se, and in its familiar role as an induction agent for ether. Cyclopropane is fairly but briefly presented.

Dr. Flagg is primarily interested in inhalation anesthesia and states that "a personal experience with ether (gas-oxygen-ether) as an anesthetic has left the author cold to the claims of other agents suggested as basic routines." With this statement in mind, one should not be surprised that on the subject of local and regional block, including spinal anesthesia, the author's presentations are disappointingly brief. One gains the impression that he is definitely hostile to the technic of spinal anesthesia, as he states that "its routine use in uncomplicated cases serves but to bring it into disrepute." However the author states that he makes no attempt adequately to cover the field of local and regional block, and refers the reader to other texts. The above comments also apply to the chapters on continuous spinal and continuous caudal anesthesia, and to his very brief treatment of intravenous anes-

thetia with sodium pentothal, this latter subject being presented in the closing pages of the chapter on ether anesthesia.

Because of his limited treatment of spinal and intravenous anesthesia, two technics of widespread application in Naval medical activities, this reviewer feels that Dr. Flagg's book would not greatly appeal to the majority of medical officers seeking information on these technics. However it is thought that this text is of everlasting value in its stress upon the fundamental precautions and safeguards to be taken in the application of any anesthesia, regardless of type.

ARTHRITIS, And Allied Conditions, by *Bernard I. Comroe, A.B., M.D., F.A.C.P., Associate in Medicine, University of Pennsylvania; Senior Ward Physician and Chief of the Arthritis Clinic, Hospital of the University of Pennsylvania.* 3d edition, enlarged and thoroughly revised. 1,359 pages; illustrated with 329 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1944. Price \$12.

Arthritis and related conditions are thoroughly and comprehensively discussed in this volume. While the book is intended for the general practitioner, it could, with profit, be included in the library of the rheumatologist, physiotherapist and orthopedist. The material is presented in a readable, interesting fashion and is intensely practical.

Even a moderately complete enumeration of the contents would cover a space far beyond the scope of this review. As is fitting in a volume of this nature, rheumatoid arthritis, osteo-arthritis, spondylitis and fibrositis are given much space. Gout and the various forms of infectious arthritis and the relatively uncommon and rarer arthritides are adequately covered. Of particular interest, from the standpoint of the general practitioner, is the thorough treatment given the subjects of subacromial bursitis, painful feet, back-ache, spondylolisthesis, internal derangement of the knee joint, sciatica and herniated lumbar disk. These entities and numerous other conditions associated with pain are given very extensive treatment with frequent tabulation and summation of symptomatology, diagnosis, differential diagnosis and treatment.

For a volume of this nature the subject of rheumatic fever is adequately handled. However it is thought that more attention might have been directed toward the painful residuals of rheumatic fever. While the author has directed attention toward the possible relationship between this disease and rheumatoid arthritis, it is believed that greater stress might have been directed toward this phase of these diseases.

The laboratory and diagnostic aids, including x-ray, used in the differentiation of the various conditions covered are given thought-

ful and critical evaluation. The illustrations and x-ray reproductions are numerous and extremely interesting.

The author has covered the entire field of the therapeutic armamentarium evolved for the treatment of arthritis. The evaluation of the usefulness of the various procedures is objective and unbiased. The subject of chrysotherapy is treated in a separate chapter, with concise directions for its use and the precautions to be observed during its employment.

It is particularly gratifying that the subjects of massage and physiotherapy are given adequate space. Neglect of these procedures by physicians in the past has unfortunately often thrown the arthritic into the hands of the quack. From the standpoint of wartime medicine, one might have desired a more thorough review of the subjects of occupational therapy and rehabilitation.

The newer therapeutic measures, such as the use of penicillin, are briefly but adequately evaluated.

The vast field covered by this volume is indicated by the variety of the subject matter listed in the very complete index. This book justly deserves a place in the library of most physicians.

MASSAGE AND REMEDIAL EXERCISES, In Medical and Surgical Conditions, by Noël M. Tidy, Member of the Chartered Society of Massage and Medical Gymnastics; T.M.M.G.; Sister-in-Charge of the Red Cross Massage Clinic, High Mycombe. 6th edition. 480 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price \$6.

This is the sixth edition of a textbook on massage and exercise that has been used by physical therapy students in England and the United States since the first edition was published 8 years ago. The three chapters on the management of fractures have been completely rewritten. Here is outlined in a systematic manner the acute treatment, time of immobilization, and physical methods used in the care of fractures. In these chapters there are many references to the orthopedic writings of the noted English authority, Watson Jones.

The style of writing is that of a typical English textbook, with the etiology, symptoms, pathology, and treatment of the many conditions amenable to physical therapy systematically described. As indicated by the title, only massage and remedial exercises are emphasized, but these are described in detail. The technic of sling suspension exercise is outlined, and indications given for its use. The book is greatly enhanced by the many photographic illustrations of the various exercise positions.

One criticism is that the book was not written in collaboration with a physician, but many medical texts have obviously been used for reference, particularly in the description of the etiology, symp-

toms, and pathology of the many disease conditions described. A very adequate program of massage and exercise has been outlined for each such condition, and the contraindications and cautions to be observed in the use of physical agents have been clearly pointed out in each instance.

This book certainly should serve as a useful text for physical therapy technicians and as a concise reference work for medical officers interested in this field. It will be found most valuable as a guide for proper therapeutic exercise. There is not a comparable textbook published in this country.

ATLAS OF THE BLOOD IN CHILDREN, by *Kenneth D. Blackfan, M.D., Late Thomas Morgan Rotch Professor of Pediatrics, Harvard Medical School; Louis K. Diamond, M.D., Assistant Professor of Pediatrics, Harvard Medical School; with illustrations by C. Merrill Leister, M.D., Associate Pediatrician, St. Luke's Hospital, Bethlehem, and Allentown General Hospital, Allentown, Pennsylvania.* 320 pages; illustrated. The Commonwealth Fund, New York, 1944. Price \$12.

The outstanding characteristic of this book is the faithful reproduction and the effective detail with which the colored plates have been executed. In this respect they are comparable to the plates in the original edition of Spalteholz, "Atlas of Human Anatomy," to which indeed this atlas on hematology provides a worthy, and in every sense, a complementary contribution.

In selecting the subject matter to be reproduced in the plates, the authors have displayed rare good judgment and a remarkable ability to combine the academic with the practical.

The content of the text is equally well chosen. It is presented in that informal, well-balanced manner, so widely recognized as an outstanding feature of the teaching methods so successfully employed by Blackfan and his associates. There are abstracts of appropriate case records.

The blood changes which may occur in early life and childhood have never been presented more clearly or more effectively. The volume is of equal value to the undergraduate, the general practitioner, the specialist and the instructor.

The necessity for studying the blood as a part of an over-all constitutional clinical picture rather than as a system by itself is emphasized. Likewise is stressed the necessity for treating the patient as an individual instead of simply considering the blood picture.

In addition to an excellent treatment of the morphology of the formed elements of the blood, equally good discussions of the abnormalities of the clotting mechanism and of the Rh factor are presented.

As a reliable working guide to employ in the diagnosis of those

clinical conditions encountered in early life which present abnormalities in the blood, this volume will probably be without an equal for some time to come.

THE DENTIST AND HIS PATIENT, A New Concept of Dental Practice, by *David Friend, Executive Director, The New Organization, Inc.; George D. Kudler, D.D.S.; Myron M. Lieb, D.D.S.; Robert Ritt, D.D.S.; and Arthur A. Friend, D.D.S.* 480 pages. Revere Publishing Co., New York, publishers, 1944. Price \$10.

How many dentists have felt that some day something should be done to reorganize their civilian practices on a more efficient basis, so that the patient might be educated to demand the full benefits of modern dentistry, while the doctor himself is adequately repaid both in fees and in the personal satisfaction that comes with a profession well done?

This is the ambitious program undertaken by the authors of "The Dentist and His Patient;" and there is little question as to the desirability of the program they advocate:

That each patient be educated to understand, agree, and cooperate with a long-term plan of treatment which stresses prevention rather than stop-gap remedial service; that an exhaustive examination, including complete radiographs and a diagnostic model, be required before active treatment is begun; that the plan itself proceed at definitely appointed times, fee payments so arranged as to be practically painless; that the sliding scale system of fees to fit the patient's pocketbook be scrapped and replaced with one equalized fee for all to cover both operative and prosthetic treatment.

The question which remains—the human element—is attended to energetically by the authors, who take the doctor by the hand and show him step by step just how it is done, what records are maintained, when that letter is written—literally placing in the doctor's mouth words to overcome whatever resistance the patient may display.

Even though the authors understandably fall short of their ideal goal, their work may be read with interest and, in many cases, profit to the dental practitioner.

TRICHINOSIS, by *Sylvester E. Gould, M.D., D.Sc., Pathologist and Director of Laboratories, Eloise Hospital, Eloise, Michigan; Assistant Professor of Pathology, Wayne University College of Medicine, Detroit.* 356 pages; illustrated. Charles C Thomas, Springfield, Ill., publishers, 1945. Price \$5.

The book should accomplish the author's stated objective: "To bring the more important aspects of this disease to the attention of workers in the field of medicine and possibly also to the attention of producers of pork."

It is a comprehensive and detailed monograph that climaxes almost ten years of serious study of the disease by the author. A knowledge of the clearly presented facts by those responsible for the public's health should go a long way toward eradicating this preventable disease.

An outstanding feature of the book is the excellence of the illustrations, particularly the photomicrographs.

A METHOD OF ANATOMY, Descriptive and Deductive, by J. C. Boileau Grant, M.C., M.B., Ch.B., F.R.C.S. (Edin.), *Professor of Anatomy in the University of Toronto*. 3d edition. 822 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price \$6.

To the average medical officer, whose knowledge of anatomic facts decreases alarmingly in direct proportion to his length of service, this book is recommended without qualification. It offers in one comparatively short and thoroughly readable volume a comprehensive review of the subject of human anatomy.

The material of the book is presented in eight sections. The first section contains a brief review of systemic anatomy. The remaining sections cover the various regions of the body. In this regional presentation, structures are considered not as isolated units but in the light of their relationships with neighboring structures. Throughout there is complete correlation of structure and function. Frequent references to embryology and to comparative anatomy serve to clarify many of the points discussed.

Professor Grant's style is pleasantly informal and the volume is enhanced considerably by some 750 well-chosen original diagrammatic drawings.



ANTIFIBRINOLYTIC THERAPY

Beta hemolytic streptococci produce an exotoxin capable of liquefying human fibrin. Patients convalescent from beta hemolytic streptococcal infections usually develop an antiserum capable of neutralizing this fibrinolysin. Subsequent report shows that this streptofibrinolysin is presumably not a proteolytic enzyme. There is a parallelism between the antifibrinolytic and antitryptic titers of convalescent serums. This suggested the possibility that fibrinolysin is more closely related to trypsin than previously assumed, and that antitryptic therapy might be of value in limiting the local spread of beta hemolytic streptococcal infections.—MANWARING, W. H.: Antifibrinolytic therapy. *California & West. Med.* 62: 53-54, February 1945.

PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge

STUDY OF SULFATHIAZOLE IN CALOMEL OINTMENT AS A PROPHYLAXIS AGAINST GONORRHEA

REPORT OF 10,006 TREATMENTS

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and
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The favorable therapeutic response of venereal diseases other than syphilis to the sulfonamides, and the increased evidence of the value of the sulfonamides in chemoprophylaxis, warrant further studies on the local application of sulfathiazole in calomel ointment in the prevention of these diseases.

As a routine prophylaxis for genital lesions other than chancres, Zeve and Schneierson¹ reported on the use of a mixed ointment consisting of one-third 10-percent sulfathiazole ointment and two-thirds calomel ointment, in 10,368 prophylactic treatments. Although venereal lesions were very prevalent among the civilian population where the exposures occurred, the report reveals only 2 cases of chancroid and 3 cases of syphilis as failures. In the light of this experience, it was concluded that the ointment greatly reduced the incidence of genital lesions, and that the prophylactic effect of calomel ointment against syphilis had not been reduced by the addition of the sulfonamide.

The present report of 7,990 prophylactic treatments with sulfathiazole in calomel ointment administered intra-urethrally as a prophylaxis against gonorrhea, is a sequel to the preliminary study of 2,016 treatments previously discussed in the BULLETIN.² Similar conditions were observed in the entire 10,006 treatments administered; 4,533 were received by patients having exposure in San

¹ ZEVE, H. S., and SCHNEIERSON, S. S.: Sulfonamide ointment in routine prophylaxis of chancroid disease. U. S. Nav. M. Bull. 43: 391-392, August 1944.

² KAUFMAN, J. B., and LITTERER, A. B.: Study of sulfathiazole in calomel ointment as prophylaxis for gonorrhea; preliminary report. U. S. Nav. M. Bull. 42: 483-485, February 1944.

Diego, California, and 5,473 were administered to those having exposure in Tijuana, Mexico.

The ointment employed contained the following:

	<i>Gm. or cc.</i>
Sulfathiazole powder	4 00
Mercurous chloride, mild	8 00
Wool fat, anhydrous.....	8 00
Petrolatum, white	8 00

The consistency and melting point of this ointment permit retention intra-urethrally for a considerable time. Moreover the ointment base is stable, remaining unchanged during the course of this study.

The method of supervised prophylaxis with sulfathiazole-calomel ointment requires the patient to urinate, after which his genitals are thoroughly washed with soap and water and dried. Then 1 gm. of the ointment is inserted into the urethra and the meatus closed by compressing with finger tips. The urethra is massaged gently for 3 minutes and the patient is instructed to avoid urination as long as possible. Calomel ointment (33 $\frac{1}{3}$ percent) is applied to other body parts and massaged for 5 minutes.

Alleged failures.—In the 10,006 treatments, 10 men were admitted with a diagnosis of gonorrhea. Of these, 3 admitted exposure to a second contact on a previous day but had failed to use prophylactic measures, whereas one gave a history of complicated gonorrhea (prostatitis) which was difficult to clear up. This man had been discharged to duty 2 months before this last exposure. He and 2 other men had exposure to the same contact and all received prophylaxis. Only he became infected 5 days later. Four patients had multiple exposures, delaying in reporting for treatment 6 hours, 5 hours, 4 hours and 3 hours respectively after the first exposure. Finally the remaining 2 men denied exposure within the past 2 weeks other than the one for which treat-

Infections which resulted from exposures in Tijuana and San Diego (9 months)

Type and number of cases*	No prophylaxis	Self-administered prophylaxis			Supervised prophylaxis	
		Sheath	Calomel ointment tube	Other type	Silver & calomel ointment	Method under study
Gonorrhea (1,082).....	738	185	151	80	30	10
Syphilis (43).....	29	3	4	6	2	* 1
Chancroid (13).....	6	0	3	1	2	* 1
Lymphopathia venereum (0) ..	0	0	0	0	0	0

*These cases are not included in the report of alleged failures, as sulfathiazole-calomel ointment was used only intra-urethrally.

ment was given. Records show that these 2 received treatment within two hours after their first exposure.

SUMMARY

1. In all 10,006 treatments were administered intra-urethrally to a selected group of men who had not used any prophylactic measures prior to reporting for treatment.

2. There were 10 alleged failures (gonorrhea) reported in these studies.

3. Previous investigators have demonstrated the efficacy of sulfathiazole in calomel ointment as a prophylaxis against chancroid, and that the addition of sulfathiazole to calomel ointment does not minimize the effectiveness of calomel ointment as a prophylaxis against syphilis.

4. The use of this combined sulfathiazole-calomel ointment as a prophylaxis against gonorrhea, chancroid, and syphilis seems feasible.



A SPOT ON THE LUNG

It is futile to search in dictionaries for a definition of the term "a spot on the lung." But the term is being used with great frequency by physicians, nurses, and laymen alike. If this term is subjected to scrutiny, it is found that it may mean anything and everything that produces a shadow or an area of decreased density in a chest roentgenogram, or anything and everything that causes abnormal physical signs over the lungs. If, then, this expression has no meaning that cannot be stated more precisely in other terms, it remains to be found out why it is being used.

After all, one does not die of "a spot on the lung," but one can die of bronchial carcinoma and one might die of pulmonary tuberculosis. Along with much other evasive, medical double-talk, "a spot on the lung" is a verbal mechanism of escape from reality. In the same category belongs the term "a touch of tuberculosis" and, improperly applied, "nothing but a little thickened pleura."

For, while "a spot on the lung" is often the obscured beginning of destructive disease, it is in other cases the starting point for tuberculophobia and anxiety neuroses, conditions that are no less crippling and hardly more easily curable than tuberculosis itself. —PINNER, M.: Spot on the lung. *Rocky Mountain M. J.* 42: 292-294, April 1945.

RODENT CONTROL ON MIDWAY ISLANDS

MAYNARD S. JOHNSON

Lieutenant H (S) U.S.N.R.

There are no native mammals on Midway Islands. The earliest forms introduced were mice. Rats became established quite recently. A Hawaiian Sugar Planters' Association publication, dated 1941, reports no rats on Midway. Chief Pharmacist Charles "D" L. Hutchison U.S.N., who was stationed on Midway during the first six months of the war, says he knew of no rats on the islands at that time. Employees of the Cable Station say that the first report they heard of rats on the island was in March of 1943. If any rats were present before that time, they were so few that they passed unnoticed. From the time of their establishment, increase of rats on the island must have been phenomenally rapid, but only gradually did they become common enough to attract general attention.

In August 1943, even though rats were not common, it was noted that there was a reduction in numbers of the small flightless Laysan rail or "*kiwi*." As rats have increased in numbers they have entirely destroyed the Laysan rail and Laysan finch. They have nearly exterminated canaries and doubtless affected other bird species on the islands.

About October 1943, rats were becoming common enough to attract attention. Since then they have undoubtedly increased manifold.

Probably rats were first brought ashore on Midway Islands with cargo; first on Sand Island where ships dock, and doubtless soon after were transferred with cargo from Sand Island to Eastern Island. It is reported that rats are unloaded from ships with practically every cargo which contains foodstuffs or soap. On 6 September 1944, a litter of 4 hairless baby rats was found in a shipment of bundled cargo net in the cargo shed on Sand Island.

Rats on Midway Islands are not dependent on military installations for food sources. Once the rats had been established through shipping, the rat population would probably be no less if the islands were uninhabited.

Relation of rats to military buildings and stores.—Nearly every galley, dry-stores room, and provision storage building on the base had an infestation of rats. It is reported that rats frequenting the

Post Office and Ship's Service, gnaw into packages containing candy or other food. These places are not centers of infestation, because for the most part rats do not live in the buildings or remain in them during the day. Inasmuch as the buildings, and the food they contain are accessible, they are visited by the rats living in the area around and under the buildings. Rat population in building areas is comparable to that in bare sand areas without buildings, and generally is much less than in bush-covered (*scaevola*) areas.

Most of the permanent buildings are of substantial construction, and control of rat infestation in these buildings is primarily a matter of locating and closing with heavy screen or sheet metal, the openings through which rats gain entrance. In one activity two openings along pipes through the wall near the ceiling were clearly marked by dark stains of grease and dirt as routes of rat travel. It was recommended that sheet metal such as tin cans cut open and flattened, be fitted snugly around the pipes and fastened to close the openings, and that a search be made to locate and eliminate any other opening by which rats might gain access. Trapping was also recommended, to follow taking of all practicable measures to exclude rats. In connection with some of the more obvious repairs needed to exclude rats from galleys and dry stores, it was occasionally reported that "a chit is in to have that done." The impression was gained that a chit involved considerable delay, and that in the meantime the situation could have been remedied by improvised or literally "stopgap" repairs by galley personnel.

Inspection of one barracks where there had been several recent cases of men being bitten by rats, disclosed various openings at the bottom of the corrugated metal sides of the buildings, through which rats could enter, but there were no dark stained trails to indicate that rats were using these narrow routes. Barracks doors were ordinarily kept open, and rats could come in and out at will. There was no evidence of rats living in the barracks, or coming into the building in the daytime. Trapping had been started in the barracks after the first man had been bitten. It was reported that 12 rats had been caught in 2 traps in one night by resetting traps under a table which was used for birthday cakes, cookies, and other refreshments eaten in the barracks.

It was recommended: (1) That doors to barracks be kept shut, especially at night; (2) that rat traps be set and tended in barracks by someone quartered in the barracks and interested; (3) that no food or crumbs be allowed to remain overnight in the barracks, accessible to rats, except bait for traps; (4) that search

be made for entrances other than doors, and that these entrances be closed by sheet metal or heavy screen.

Relation to military personnel.—From various parts of both islands instances have been reported of rats infesting sleeping quarters of personnel, running across men as they sleep, crawling into bed, nibbling epidermis from tips of fingers and toes. In a few cases men have actually been bitten by rats. There have been no injuries of any consequence, but such happenings are disquieting. Rats are capable of carrying and transmitting to man several diseases, either directly or through parasites, or through contamination of food. Nonoccurrence of any such diseases among personnel makes it appear that such diseases are not present in the local rat population. The potential danger would promptly become an actual one if disease-carrying rats should be introduced with shipping and spread infection in the established rat population.

Relation to birds.—The rat population on the Midway Islands is in large part dependent on the bird population. During much of the year, eggs and young of various seabirds are believed to be a principal source of food for the rats. Most of the rats live in burrows of the "small moaning bird" (Bonin Island petrel), and presumably maintain themselves largely at the expense of this species. Definite figures on population changes of this and other birds are unavailable. Moaning birds are so numerous that the effect of rats on their numbers is not immediately apparent. In the period from August to December 1944, small moaning birds were the most abundant bird species. The adults are small and comparatively defenseless and stupid; the young were not seen during that time. Rats have killed all the rails and finches, and all but a few canaries; all of these were not indigenous but had been introduced. Canaries were formerly fed each day at the Cable Station. In a number of instances rats are believed to have destroyed eggs and young of white terns. Occasionally rats kill the young of the albatross.

Sooty terns and moaning birds are frequently killed by traffic. In addition, numbers of moaning birds, mostly small, were killed with clubs because they dug up lawns and flower beds, and because the call of the large moaning bird (wedge-tailed shearwater) disturbed sleep. In August and the early part of September, rats ate the flesh from carcasses of these birds. By the latter part of September it was noted, however, that the dead birds often were left unmolested, probably because fruit of the scaevola bush was becoming available.

Rat species, and population estimates.—The rat population on Midway Islands consists of two varieties of climbing rats, the

roof rat or gray rat (*Rattus rattus alexandrinus*) and black rat (*Rattus rattus rattus*). The alexandrinus is the predominant variety, and makes up four-fifths or more of the total population, although both kinds are generally distributed and have similar habits. No evidence has been found of the occurrence on Midway Islands of the brown rat (*Rattus norvegicus*), which is bigger and more aggressive than the varieties of rat already established, reproduces faster, is more carnivorous, would be more destructive to birds, and probably more dangerous to personnel.

Evidence from trapping, and from pans of feed used in pre-baiting, indicates that there is no type of terrain, however uninhabitable it might seem, without its own population of rats. This applies to bare sand flats, gun positions, unoccupied and occupied dugouts, and artificial hills of fuel storage areas. The densest population of rats is in bush-covered (*scaevola*) area which is also the area of most moaning bird burrows, and most favorable conditions of food and shelter for rats.

Judged on the basis of amount of bait taken from feed pans in areas not previously poisoned, the rat population in *scaevola* areas was about 100 rats per acre, perhaps somewhat less on Sand Island and considerably more on Eastern Island. In other areas less favorable for rats, including building areas and artificially arranged sand formations, rat population on Eastern Island was considerably above the population of comparable areas on Sand Island. The difference noted was probably due to a history of more extensive trapping on the parts of Sand Island where population estimates have been made.

Previous attempts at control.—It is reported that when rats were first found on Sand Island (March 1943) the senior medical officer undertook poisoning with red squill to try to destroy the rats before they could become firmly established. Rats increased despite control measures with poison. After a few months, rats not being controlled, poisoning was discontinued.

Later as rats continued to increase, reduction by trapping was undertaken in certain areas. Although detailed records are not available, several thousand rats were trapped in a sectional activity on Sand Island, in a campaign lasting about two months. Prizes were offered. The most successful trapper continued trapping after the organized campaign lapsed, being released from other duties for this purpose. He extended his trapping to adjoining areas, and in six months (March to September) trapped 3,800 rats, with catches toward the end of the period at the rate of about 40 rats per 100 traps nightly. This intensive trapping undoubtedly thinned out the rats in the area so trapped, but as the

trapping affected only a small part of the island, it is probable that the rat population of the island as a whole increased during the period of this trapping.

Because small-scale or halfway measures cannot succeed, the rat control program must be of a broad scope. The majority of the rats are immature, though well nourished, and many are fat. Observations indicate a thriving population and high rate of natural increase. With abundant harborage and food, and apparently no natural enemies, they can be expected to increase to the limit of their food supply. Rats tend to become bolder with increase in numbers, particularly in case of food shortage, seasonal or otherwise. Under such circumstances attacks by rats on personnel can be expected to become more frequent and more determined.

EXPERIMENTAL WORK

Experiments were undertaken to find what bait combinations were best taken by rats, and what poison preparations were most effective. Experiments included both field tests and cage feeding tests with live trapped rats. A series of fifty feeding stations was obtained and set out in the area around the Cable Station dispensary, and baited to test the acceptance by rats of different types of food. Rolled oats (oiled with mineral oil, and sweetened), raw hamburger, and apple were offered, separately and in different combinations. The rolled oats preparation was the preferred food, hamburger next, and apple last. Rats came to stations with more than one food sooner than to stations with only a single food.

To test a report that linseed oil smeared on the inside of the covers of feeding stations attracted rats and enabled them to find the bait more readily, at 37 of the stations raw linseed was smeared on the inside of the covers. No difference was found in acceptance of bait at stations with or without linseed oil. The test of linseed oil on station covers was repeated later with a larger series, likewise without demonstrating any effect.

As rolled oats were not available in quantities that would be needed for baiting and poisoning, a comparison was made of acceptance of the rolled oats and of baits with bread crumbs with mineral oil and sweetening, and also with mineral oil, sweetening and milk powder. No difference was apparent in acceptance of these baits, both bread-crumbs baits being accepted fully as well as the rolled oats bait. Bait used was:

	<i>Gm. or cc.</i>
Bread crumbs (ground from dried sliced bread)	16,000
Mineral oil	1,250
Cane syrup	500
Powdered milk	400

Later, with bread crumbs no longer available, an equal amount by volume of yellow cornmeal was substituted for bread crumbs in the bait formula. In another series of bait acceptance tests, bread crumbs were accepted more promptly than cornmeal in newly placed stations, in a new area where neither bait had been used. Bread-crumbs bait continued to be taken in greater amount by volume (approximately equal amount by weight) as compared with cornmeal bait. Mixed cornmeal bait (with oil, sweetening, and milk powder) was taken in greater amount and at a larger proportion of stations than straight unmixed cornmeal. A slightly greater acceptance was found for bait mixed with cottonseed oil, than for bait mixed with mineral oil. Cornmeal mush was taken more promptly than either the mixed cornmeal bait or unmixed cornmeal bait. It was a less satisfactory bait, however, as it spoiled readily. Also, apart from spoilage, an oil-mixed bait is more effective than a wet bait with zinc phosphide which was the most effective poison used.

A comparison was made of acceptance of bait mixed with mineral oil and a similar bait with peanut butter and cottonseed oil (cooking oil) as the oily constituents.

Peanut-butter bait was as follows:

	<i>Gm. or cc.</i>
Yellow cornmeal	16,000 (1 case)
Peanut butter	1,600 (1½ can)
Cottonseed oil (cooking oil)	400
Cane syrup	500
Powdered milk	400

After preliminary mixing, a smoother mixture was obtained by screening; rubbing the bait first through 4-mesh wire cloth, then through 16-mesh window screening, stirring after each screening to offset the sorting effect of the screen.

Bait mixed with peanut butter was placed at odd-numbered stations, and bait mixed with mineral oil at even-numbered stations, in several series aggregating about 450 stations. In each series the proportion of bait taken from the peanut-butter stations showed a rise, approaching or exceeding twice the amount of bait taken from the mineral-oil stations. The same experiment demonstrated that the take of poison bait is greatly influenced by the attractiveness of unpoisoned bait used in prebaiting. Following prebaiting as described, unpoisoned bait was taken up and poisoned bait was placed which was the same at all stations (bait poisoned with zinc phosphide and containing peanut butter). Seventy-five percent more poison bait was eaten at stations prebaited with peanut butter bait.

In a later test it was found that there was only a slight, if any, difference between acceptance of bait containing approximately 3-percent and 9-percent peanut butter. Because peanut butter was more difficult of procurement than other items in the bait mixture, it seemed advisable to use the smaller proportion in pre-baiting. Another modification of the bait formula which seemed desirable for reasons apart from acceptability, was the substitution of brown sugar for syrup, because in bait poisoned with zinc phosphide, moisture content of the syrup had a tendency to cause decomposition of the poison.

Bait that becomes wet, molds and is no longer attractive to rats. At stations in sandy locations, sand is blown into the bait pans on windy days. Even a small amount of sand in the bait makes it unattractive to rats. Bait spoiled by sand or water must be discarded. Other forms of used baits can be salvaged and reused.

Further experiments on the acceptability of various bait combinations are essential, as improving baits probably offers the best opportunity for increasing the effectiveness of prebaiting and poisoning.

Poisons.—The first poison tried was 10-percent squill, fortified and standardized to kill at from 500 to 600 milligrams of poison per kilogram of body weight. There was relatively poor acceptance of this poison bait, which in the most successful series and judged by the amount of bait eaten by survivors, killed approximately half of the rats prebaited.

The next poison tried was 3-percent alpha-naphthyl thio-urea (Antu), a new rat poison developed commercially. With this poison the chief difficulty was the rats' poor acceptance of the poison bait. In one series of stations the kill with Antu, judged from bait eaten by survivors, was somewhat greater and in another series somewhat less, in proportion to the number of rats prebaited, than in the most successful series with 10-percent squill. In both cases cited, and with both poisons, the low percentage of kill was attributed to poor acceptance of the poison bait by rats.

The next bait was made up with 5-percent squill. The acceptance of this bait was better. The rats which had been offered 10-percent squill previously, took not only more poison bait of the 5-percent squill but more actual squill in proportion to the number of rats prebaited than when 10-percent squill was offered.

In all the series, as judged from take of unpoisoned bait following poisoning, the kill with 5-percent squill bait was negligible and too small to be measured. The reason for this paradox was unknown. The 5-percent squill bait was toxic enough to kill. A

young alexandrinus rat in a cage, not hungry and with unpoisoned apple as well as 5-percent squill bait placed before it, ate a sufficient amount of the poison in one night to kill it before morning.

The most successful results have been obtained with zinc phosphide. The first application of this poison at this base was in one-percent mixture to survivors of repeated baitings and poisonings. The prepared bait gave off a strong odor of phosphin gas from decomposition of the zinc phosphide. This poison was likewise taken only sparingly by the rats, and was judged to give approximately 50-percent kill.

The next lot of poison bait used on rats in an area prebaited but not previously poisoned, was a zinc phosphide and magnesium carbonate mixture (two parts zinc phosphide to one of magnesium carbonate). The addition of the carbonate stabilized the zinc phosphide so that there was only a trace of gas odor from the bait.

With this preparation, the acceptance in 4 days was more than two-thirds the average daily acceptance of unpoisoned bait during the final days of prebaiting.

As magnesium carbonate was available only in very limited supply, calcium carbonate (prepared chalk) was next used; one part to two parts of zinc phosphide. It proved to be as effective in stabilizing the zinc phosphide, and was as readily taken in bait by rats as the magnesium carbonate. By substituting brown sugar for syrup, omitting any moist ingredient from the poison bait mixture, the tendency of the zinc phosphide to decompose was further reduced.

Although zinc phosphide was now taken in amounts that should have been sufficient to kill all rats that had been eating unpoisoned bait prior to poisoning, upon rebaiting with unpoisoned bait following poisoning there were still rats to visit the stations and eat the bait. This naturally raised the question of whether or not the poison was effective in killing the rats, and what dosage was required to kill. These questions could be answered only by cage feeding tests.

Live traps were prepared by fastening 1-gallon cans to ordinary traps. A flattened piece cut from another can, wired to the movable guillotine arm of the trap, served as a door closing the open end of the can when the trap is sprung. A wire trigger extension was arranged reaching nearly to the far end of the can. The bait most used was peanut butter smeared on absorbent cotton and fastened to the end of the trigger extension. This live-trap is easily made with materials and tools readily available, and is effective.

Captive rats were kept in improvised cages. In tests involving about a dozen rats, of which some escaped before tests were com-

pleted, it was found that rats are killed by zinc phosphide in dosage of about 100 mg. per kg. of body weight, but sometimes survive dosage of 50 mg. per kg. of body weight. The effect of zinc phosphide is cumulative, and rats and mice are killed by repetition of a small dose of poison. One gram of poison bait containing 7.5 mg. zinc phosphide per gram is sufficient to kill a small rat weighing 2½ ounces. Three grams (4.5 cc.) of the poison bait is enough to kill any but the very largest rat.

Although these experiments indicate that greater dosage of zinc phosphide is required to kill than has been reported in published figures, they indicate that the zinc phosphide preparation used is sufficiently toxic to be an effective poison. Caged rats eat from 20 to 40 cc. of unpoisoned bait every day, in addition to a supply of apple. The apple permits a change. Poison bait to the extent of one-eighth of the daily take of unpoisoned bait is sufficient to kill caged rats. Although it is probable that many of the rats that eat at feeding stations take less bait than caged rats, still it seems certain that practically all the rats that form the habit of eating at feeding stations are killed by poison when the take of an effective poison is two-thirds or more of the daily take of unpoisoned bait. It seems equally clear that most of the rats eating at a feeding station rebaited following poisoning are "new customers" not previously eating at the station, rather than "old customers" who survived the poisoning.

Zinc phosphide poison bait, with chalk mixed with the poison to stabilize it, and mixed without syrup or other moisture containing ingredients, may be salvaged following exposure in feeding stations, and re-used without appreciable loss of toxicity. The salvaged bait, provided it has not been wet and contains no sand, is accepted about as well as freshly mixed bait.

Six days of prebaiting before poisoning, the period first used under conditions here is not long enough, as consumption of food at the stations continues to increase with several additional days of prebaiting. Under conditions prevailing on the Midway Islands, with the rat population already well-fed, it has not been possible, with baits so far used, to attract all the rats of an area at any one time to feed at the feeding stations. Present practice is to prebait for from 8 to 10 days, then poison for 3 or 4 days; then to repeat with another cycle of baiting and poisoning in order to attract and destroy some of the rats remaining after the first operation.

It must be remembered that effectiveness of a particular bait or bait-and-poison combination, may vary seasonally with the natural food available to the rats. Accordingly experimental de-

partures should be made from time to time, varying the customary formulas to see if improvements can be made.

PROPOSED METHOD OF RAT CONTROL FOR MIDWAY ISLANDS

In buildings.—Entrance of rats into buildings directly affect military interest, from the point of view of morale and health of personnel, and destruction and spoilage of food and other supplies. Personnel occupying or responsible for a building are made responsible for control of rat infestation in their own area.

Most rats entering tight rooms or buildings come in through the doors. Outside doors, and doors to food storage compartments, should be kept shut, especially at night. Ascertaining that doors do not bind against deck or frame, and that they are pulled shut by strong springs, will help to insure against doors being carelessly left open. Thereafter careful search should be made for all other openings by which rats may enter, and these should be closed by heavy screen or sheet metal. Foodstuffs should be kept in a carefully rat-proofed compartment. If despite precautions some rats get into the buildings, trapping will be made easier because of the precautions.

In trapping, various baits should be tried. Peanut butter and apple have proved especially attractive. However apple loses most of its attractiveness to rats as it loses its freshness, and is not a good bait after the first day. Peanut butter is an attractive bait for several days. If there is any tendency for rats to steal the bait, a piece of apple may be tied to the trigger, or peanut butter may be smeared on a piece of absorbent cotton tied to the trigger. If as a result of prolonged trapping, surviving rats become wary of traps, leaving the traps baited but not set for a few nights may help to overcome this fear.

Out-of-doors.—Nearly all rats, including those which enter buildings for food, live out-of-doors. Most of the rats do not frequent buildings and are independent of military food supplies. In building areas, reduction of rats is hastened by trapping. The general distribution of rats throughout the entire area of the two Midway Islands, and the high population level, require control operations with systematic coverage of successive areas, extending progressively across the whole of each island. This may be avoided only if enough baiting stations and personnel are available to operate in different zones all over the islands at the same time. Such systematic coverage can best be accomplished by a detail of men assigned for the purpose. Two details, each consisting of five men from as many different organizations and each under the direction of a pharmacist's mate, have been estab-

lished and are operating, one on each island. Recently five additional hospital corpsmen have been assigned to the detail on Sand Island to allow greater progress in covering the area.

Prebaiting and poisoning is the principal method to be employed in feeding stations. These consist in pan and cover. The covers are rectangular pieces of 28-gage galvanized iron, 15 by 16 inches, curved to resemble a covered wagon top, or Quonset hut. Each cover is stenciled for identification and serially numbered. The pans, also of galvanized iron, are 7 by 7 inches and 1½ inches high, with soldered corners. Pans first used had open corners and admitted moisture when the ground was wet, resulting in considerable spoilage of bait.

Stations are distributed over the area to be worked, spaced as evenly as practicable, at the rate of about 4 per acre and 100 feet between stations. Exact spacing, however, is not important. Stations must be placed where they are not likely to be disturbed by the traffic or other operations. In building areas, feeding stations are placed at the edges of buildings.

As the feeding stations are set out, in the order of their serial numbers, a measured amount of unpoisoned bait (about a cupful) is placed in each pan, and the pan placed under the corresponding cover. The unpoisoned bait is left in place from 8 to 10 days. Stations are checked after 4 days, and then at 2-day intervals, and more bait added and recorded. Presence of rats is indicated by rat tracks and rat droppings in the bait.

Rat patronage of the feeding stations is slight for the first day or two, but increases rapidly until a majority of the rats in the area are eating at one or more of the feeding stations. Then the remaining unpoisoned bait is taken up, measured, and poisoned bait put out. The poisoned bait is like the unpoisoned in all respects except for the addition of poison. An amount of poison bait equal to daily take of unpoisoned bait from the station is sufficient.

After the poisoned bait has been out 3 or 4 days, it is taken up and a new cycle of baiting and poisoning started. The amount of bait taken per day per station in the second baiting as compared with the first, is an approximate measure of rat population as compared with rat population prior to the first poisoning. After two rounds of the baiting and poisoning, although there are still rat survivors in the area, the stations should be taken up and placed in an adjacent area, and the program continued with systematic coverage extending progressively over the entire island, or over zones which may be worked at the same time, to accomplish complete coverage of the entire island.

The prebaiting and poisoning are to be repeated, and the island gone over systematically again and again, to reduce survivors of previous prebaiting and poisoning and their progeny. If available data are interpreted correctly, surviving rats will be for the most part rats which did not share in the unpoisoned food offered as prebait, rather than rats which have survived a sublethal dose of poison.

At the beginning of the program of prebaiting and poisoning as a method of rat control on Midway Islands, it was estimated that 500 stations would be enough to give a good measure of control on Sand Island, and that a proportionately smaller number, corresponding to the smaller area, would be sufficient for Eastern Island. This estimate was based on results reported from use of this method of poisoning rats in Hawaiian sugar cane fields, where one cycle of prebaiting and poisoning practically eliminated rats from the area treated.

Unfortunately it has not been possible to equal these striking Hawaiian results under Midway conditions. The ratio of acceptance of poisoned bait, and the toxicity of poisoned bait as demonstrated in cage feeding tests, seems sufficient to insure killing of practically all the rats attracted to the feeding stations by prebaiting. The limiting factor seems to be that other available foods are sufficient in quantity and attractiveness so that not all the rats in the area baited are drawn to the feeding stations at one time.

Instead of one cycle of baiting and poisoning destroying all the rats in an area, which required approximately 10 days in the Hawaiian experiments, approximately a month is taken under the present local condition; two cycles of somewhat extended prebaiting and poisoning being necessary, after which a proportion of rats remain unaffected by the treatment. At the end of the month the daily take of bait (and perhaps the population of rats) may be from 10 to 20 percent of the original.

Although control by prebaiting and poisoning does not operate so effectively as would be expected if the rats were not already so well provided with food and shelter, still it affords the best means available for reducing the rat population of the islands. In no other way than by systematically prebaiting and poisoning can rats be induced to take enough poison seriously to deplete their numbers.

To the extent that materials (stations, bait, and poison) and personnel are made available to expand the scope of the prebaiting and poisoning, results already obtained give assurance that rats can be made comparatively uncommon. There is no assurance

that rats can be eliminated from Midway Islands, no matter how intensive the program undertaken against them. The conclusion to be drawn from experience with these and other pests elsewhere is that probably rats are here to stay.

Aside from about 150 "permanent" stations mostly in and near the dock area, about 500 stations have been available for use on Sand Island. On the present basis of about 4 stations to an acre, a month in a place, 7 or 8 months would be required to cover the whole of Sand Island once with baiting and poisoning. Under conditions prevailing here this interval is too long, as surviving rats would multiply severalfold before their area was again reached in control operations. However the number of feeding stations on Sand Island has recently been increased and now is about one thousand.

On the basis of experience, one-third coverage (each area with feeding stations one month out of three) is the minimum that can be expected to give reasonably effective control.

Eastern Island, with replacement of some stations that have been lost, has approximately this one-third coverage. Recent additions in feeding stations and personnel for rodent control allow about one-fourth coverage at a time for the area on Sand Island. Additional pans and covers will have to be added from time to time to replace losses. If sufficient feeding stations and personnel are made available to operate over the entire area at the same time, reduction of the rat infestation would be speeded up accordingly.

Permanent feeding stations are established on and adjacent to the dock areas, to be baited alternately with unpoisoned and poisoned bait. The objective is to establish and maintain a nearly rat-free zone in this area to guard against introduction and establishment of Norway rats, and to prevent any diseased rats which may be brought in with shipping from making contact with the existing rat population on the island.

Unpoisoned bait used at present is as follows:

	<i>Gm. or cc.</i>
Yellow corn meal.....	14,000 (1 carton)
Peanut butter	500
Cottonseed (cooking) oil.....	350
Brown sugar	500
Powdered milk	250

The poison mixture is a zinc phosphide-calcium carbonate (prepared chalk) mixture, consisting of two parts of zinc phosphide (fine commercial 80-percent powder) with one part of calcium

carbonate. The calcium carbonate seems to be as effective and acceptable, and is more readily obtainable, than the magnesium carbonate first employed. The zinc phosphide-carbonate mixture is added to the oil constituent of the bait in proportions to give 7.5 mg. of zinc phosphide per gram of bait.

Precautions.—There is no record of any bait in feeding station being bothered by dogs or by ocean-feeding birds, neither apparently caring for this kind of food. It was found that some of the small land-feeding birds, particularly the ruddy turnstone, occasionally entered the feeding stations and ate from the bait pans. Plywood blocks fitted and placed at the ends of the covers, partially closing the openings, were almost entirely successful in keeping out the birds, and did not interfere with use of the station by rats. Two types of blocks were used and employed at only some of the stations. One type was paddle-shaped with the pointed handle pushed in the ground, the curved blade shaped to fit under the curved cover, with openings at sides and bottom more than enough for rats to enter. The other type of blocks were somewhat rectangular pieces, $8\frac{1}{2}$ by $3\frac{1}{8}$ inches, curved at the ends to fit the cover, and held in place by nails through the cover. This type of block was serviceable where conditions did not permit pushing into the ground.

A possible further safeguard against accidental poisoning may be provided, by incorporating tartar emetic in the poison; 4 parts of tartar emetic (antimony and potassium tartrate) with 7 parts of zinc phosphide according to the Fish and Wildlife Service recommendation. However the effectiveness of this emetic with birds has not been determined.

RECOMMENDATIONS

It is recommended that rat population within buildings and in their immediate vicinity can be dealt with most effectively by personnel occupying or responsible for each building. The necessary steps are: (1) Preventing rats from getting into buildings by keeping the doors shut, especially at night, and by covering with heavy screen or with sheet metal other openings through which rats enter; (2) preventing access of rats to food in buildings—provisions and dry stores should be in carefully rat-proofed storage compartments; garbage should be kept in covered G.I. cans; crumbs, food scraps and candy or remains of lunches should be regularly disposed of before lights go out at night; and (3) persistent trapping.

The generally high level of rat population throughout practically the entire area of both islands requires systematic area

coverage in a rat-control program. Any campaign against rats, undertaken for a while and then neglected or dropped, will have no lasting effect. Elimination of rats from these islands probably is not a practicable possibility. A continuing program of rat control, vigorously followed, will be necessary to keep rat numbers below the level where the rats are a nuisance and a menace.

It is of great importance to prevent establishment on these islands of a species of rat (Norway rat) not now established, or of rats carrying diseases communicable to man. A partial safeguard against introduction and establishment of these undesirables is provided by a series of prebaiting and poisoning stations permanently placed along the docks and the area immediately behind, together with trapping in dock buildings.

Supervisory officers should be alert to see that rodent control operations do not become perfunctory. A part of the effort must be devoted to experiment to make the procedure more effective, and to adapt it to changing circumstances. Bait acceptance tests, using different bait combinations, should be made at frequent intervals, using available materials in most palatable combinations, possibly varying with seasonal changes of natural foods available to the rats.

The prebaiting and poisoning method of control here proposed is patterned so far as seemed feasible on a method originally developed (1938) by R. E. Doty of Hawaiian Sugar Planters' Experiment Station. The work of fitting the program to the local conditions and to available baits and poisons has been facilitated by the staff of the medical department, particularly the former senior medical officer, Commander R. F. Atsatt (MC) U.S.N.R., and the former sanitation officer, Commander H. M. Chandler (MC) U.S.N.R. The expansion in scope and effectiveness of the program, accomplished and pending, is made possible through the interest of their reliefs, Captain H. L. Wyatt (MC) U.S.N. and Commander P. S. Haley (MC) U.S.N.R.



OPHTHALMOSCOPE AS TRANSLUMINATOR

In the absence of special transilluminating devices the standard ophthalmoscope with the May lens head removed may be employed in the visualization of the accessory nasal sinuses, eyes, cysts, questionable hydroceles and other similar hollow structures. The exposed small rounded bulb will not burn the patient and the variable light intensity often aids in detecting shadows and foreign bodies. Foreign bodies embedded in the fingers and distal portion of the hand proper have been located and removed by this method. The detachable portion of the lamp may be sterilized by autoclaving or by alcohol.—MEISINGER, G. F., Lieutenant, junior grade (MC) U.S.N.

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UNITED STATES NAVAL MEDICAL BULLETIN

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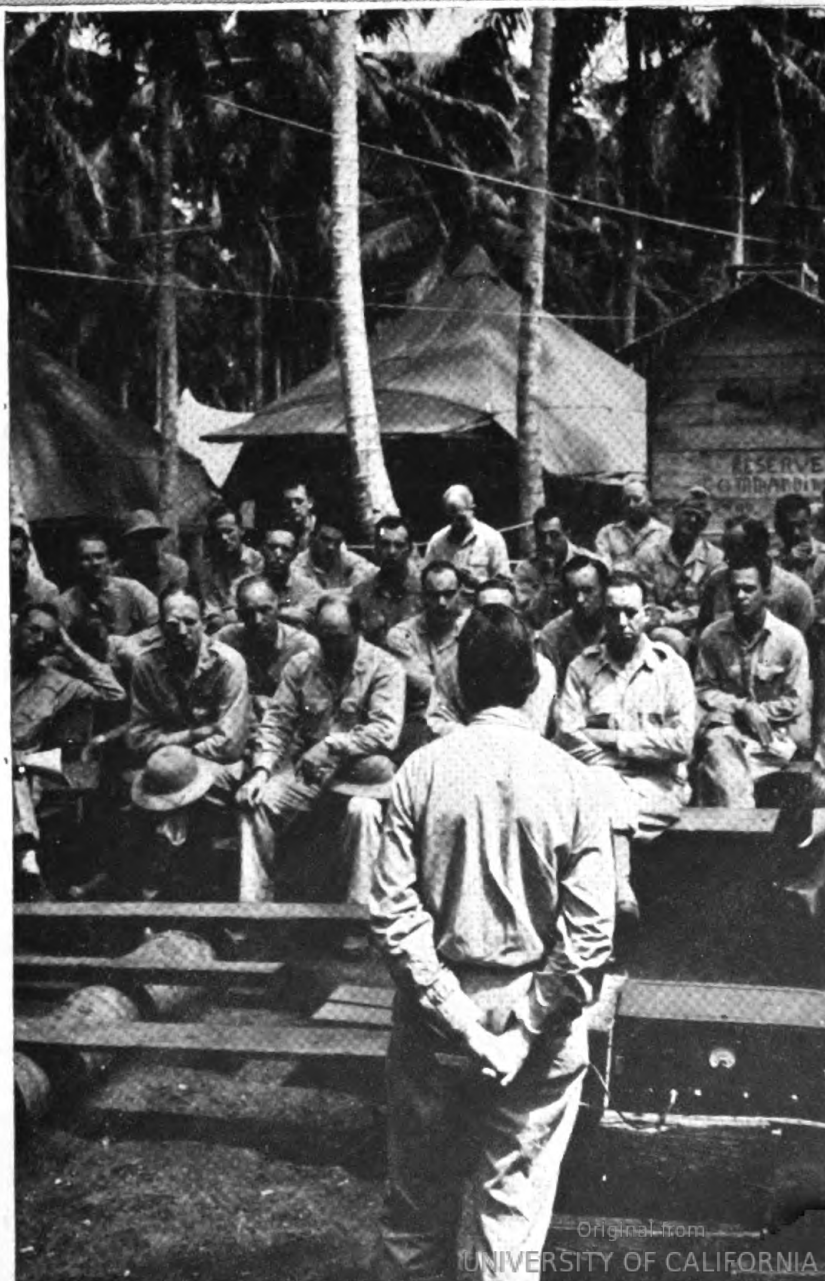
NUMBER 3



SEPTEMBER 1945

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED 112



COVER PHOTOGRAPH

The first general meeting of the Solomon Islands Medical Association, held on Espiritu Santos, on 4 March 1943. Commander John H. Willard (MC) U.S.N.R. is reporting on the first hundred cases of acute infectious jaundice seen in the area. Other speakers were Commander Donald McCarthy (MC) U.S.N.R., then chief of medicine of the U.S.S. RELIEF, and Lieutenant Colonel H. A. Stephenson, M.C., A.U.S., of the 25th Army General Hospital. The officer in boots at right is Commander Albert Salisbury Hyman (MC) U.S.N.R., president of the association.

VOL. 45

SEPTEMBER 1945

NO. 3

UNITED STATES
NAVAL
MEDICAL
BULLETIN



MONTHLY

DIVISION OF PUBLICATIONS
BUREAU OF MEDICINE AND SURGERY

Compiled and published under the authority of
Naval Appropriation Act for fiscal year 1946,
Public Law No. 62, approved May 29, 1945

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1945

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
See page II for prices

NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

All numbers up to and including 1921.

Volume 16, 1922, Nos. 4 and 5.

Volume 17, 1922, Nos. 4 and 6.

Volume 18, 1923, Nos. 1, 2, 3, and 5.

Volume 19, 1923, Nos. 2 and 3.

Volume 20, 1924, Nos. 2, 5, and 6.

Volume 24, 1926, Nos. 1, 2, and 4.

Volume 25, 1927, Nos. 1 and 4.

Volume 26, 1928, Nos. 1, 3, and 4.

Volume 27, 1929, No. 4.

Volume 28, 1930, No. 1.

Volume 31, 1933, No. 3.

Volume 42, 1944, No. 2.

SUBSCRIPTION PRICE OF THE BULLETIN

Subscriptions should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Yearly subscription, \$4; foreign subscription, \$5.

Single number, domestic, 35 cents; foreign, 45 cents, which includes foreign postage.

Exchange of publications will be extended to medical scientific organizations, societies, laboratories, and journals. Communications on this subject should be addressed to the Surgeon General, United States Navy, Washington 25, D. C.

PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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Contributions to the **BULLETIN** should be typewritten, double-spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The **BULLETIN** endeavors to follow a uniform style in headings and captions.

Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

The editors are not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

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United States Naval Reserve, Retired.

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U. S. NAVAL MEDICAL BULLETIN

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No. 3

SPECIAL ARTICLES

SCHISTOSOMIASIS IN NAVAL PERSONNEL

A REPORT OF SIXTEEN CASES

ALBERT R. HUNT

Lieutenant Commander (MC) U.S.N.R.

The following is a study of the clinical features, course, and therapeutic management of 16 cases of schistosomiasis among Naval personnel seen on the island of Leyte. The disease occurred in young, previously healthy white males, all enlisted personnel, ranging in age from 19 to 27 years. These men arrived on the island of Leyte during the last week in November and first week in December 1944. All but two were engaged in construction work which took them some distance inland from the coast and, no other facilities being available, for a period of several weeks they bathed two or three times daily and did their laundry in a river. At the expiration of that time, showers and adequate bathing facilities were available to them. The nature of their work also required being in rice paddies for long periods of time. The men worked without shirts and in shorts.

Two men, members of a construction battalion stationed on the island, on two occasions went duck hunting in the rice paddies. They stayed in the paddies approximately 4 hours on each occasion. During that time they were wading ankle-deep in the water of the paddy.

The time interval between the earliest date of exposure by wading or swimming in infested waters and the date of onset of symptoms varied from 2 to 6 weeks. In five men this interval was 6 weeks; one patient was aware of symptoms 5 weeks after exposure; in six cases it was 4 weeks, in one $3\frac{1}{2}$ weeks and in two 2 weeks. One man had been symptom free, but on routine stool examination was found to be infected.

Three men reported to the sickbay immediately upon onset of symptoms, two reported within 3 days, two within 4 days, three after 2 weeks, one after 4 weeks, two after 5 weeks, one after 6 weeks, and one after 7 weeks. Of the 16 patients 9 were hospitalized for a period of from 2 to 19 days, the average being 7 days. The other patients were placed on a no-duty status but allowed to remain in their own tents, reporting daily to the dispensary for examination.

The 16 cases observed and under treatment at this dispensary were of moderate severity and presented clinical features of great similarity. For the purpose of brevity one case will be described in detail.

Case report.—A radio technician, first class, age 20 years, arrived on the island on 20 November 1944. On 15 December he, with his unit, went 2 miles inland for construction work. The unit remained at this location until the patient's admission to the dispensary on 30 January 1945. Living quarters were established near the banks of the river. Between 15 December and 25 January the patient bathed two or three times daily in the river and his work required wading through the rice paddies many times daily. The patient recalls several episodes of severe generalized pruritus while bathing, which subsided on leaving the water. There were no other symptoms until 30 January at which time he experienced generalized malaise, developed a moderate dry cough at night, and complained of muscular aches and pains in the extremities and of fatigue. The evening temperature elevation was 104° Fahrenheit.

The patient was admitted with the diagnosis of catarrhal fever, acute. He was hospitalized for 1 week during which time his symptoms gradually subsided. He then remained symptom free for a period of 10 days after which generalized malaise recurred and episodes of temperature elevation of 103° to 104° F. in the late afternoon, accompanied by headache. There was constant epigastric pain, mild in character, and on several occasions the patient vomited. At this time the patient noticed large areas of urticaria on the thighs and legs which occurred at any time of day and lasted 3 or 4 hours. Fleeting episodes of bilateral infra-orbital edema occurred. Anorexia was extreme. The patient was extremely weak, the slightest exertion causing great fatigue. He suffered with backache and pains in the muscles of the arms and legs. These symptoms persisted and the patient noticed that he always felt worse in the evenings. There was an estimated weight loss of 45 pounds. On 8 March he again presented himself at the sickbay.

At that time he appeared chronically but moderately ill. There was evidence of recent weight loss. His temperature was 99° Fahrenheit. A moderate degree of infra-orbital edema was present bilaterally. Areas of urticaria surrounded by marginal erythema and varying in size from 2 to 10 centimeters were present on the thighs. The heart and lungs were normal.

On abdominal examination there was moderate rigidity in the upper portion of the right rectus abdominis muscle, with tenderness to palpation in this region. The liver was palpable 2 cm. below the costal margin; it was smooth and nontender. The tip of the spleen was palpable. Rectal examination disclosed only several small thrombosed hemorrhoids. Neurologic examination showed no abnormality.

Blood studies revealed a hemoglobin concentration of 90 percent, a normal erythrocyte count and a leukocyte count of 20,050 with 38 percent polymorphonuclear leukocytes, 14 percent lymphocytes and 48 percent eosinophils. Stool examination was negative for ova and parasites on 6 March and 7 March. On 8 March *Schistosoma japonicum* was found in the stool; stool culture was negative for pathogenic organisms. Urinalysis was negative. Blood chemistry studies were not made because of lack of facilities at this activity. X-ray examination of the chest yielded negative results.

The patient was placed on a no-duty status and reported to the sickbay for daily observation and treatment. Temperature recordings were taken twice daily at 0800 and 2030. Treatment with fuadin, a trivalent antimony compound, was started on 9 March. The drug was given intragluteally every other day; 1.5 cc. being given on the first injection, 3.5 cc. on the second, and then 5 cc. until a total of 70 cc. had been administered. The treatment was given over a period of 30 days.

Until after the fifth injection of the drug (25 cc.) no clinical change was noted. The patient complained of headache, anorexia, abdominal cramps and cough, and had an evening temperature elevation of 101° to 102° F. daily. Morning temperatures varied from normal to 99° Fahrenheit. No changes were found upon physical examination. After the fifth dose of the drug, the patient's appetite began to improve but he still lacked energy and fatigued quickly. After starting treatment there was a moderate degree of constipation which was controlled by Epsom salt.

After 40 cc. of the drug had been given, the patient began to gain weight; the temperature remained normal but the symptoms of weakness and fatigue persisted, and he complained of irritability, tremors of the fingers, and mild vertigo on exertion. On several occasions he had a generalized creeping sensation of the body. Prior to the onset of this disease, no nervous symptoms had been noted by the patient.

After the full course of treatment had been given (70 cc.) there was noticed an objective and subjective improvement in the patient's general well-being. Appetite was described as good and the patient was asymptomatic except for moderate weakness and fatigue. Three weeks after the completion of treatment the patient had gained 15 pounds in weight.

Laboratory studies were conducted as follows. White blood cell counts, differential counts, and hemoglobin determinations were made before treatment, after 20 cc. of the drug had been given, on completion of treatment, and 3 weeks after treatment. After 20 cc. of the drug had been given the leukocyte count was 16,950, with 28 percent eosinophils; on completion of treatment, it was 10,200 with 20 percent eosinophils; and 3 weeks after treatment 10,600 with 16 percent eosinophils. The hemoglobin level remained at 90 percent.

One stool examination was made after 20 cc. of fuadin had been administered, three examinations after administration of 40 cc., and on completion of treatment three examinations were made, one 2 weeks after treatment, and five at the end of the third week following treatment. All of these stools were negative for ova and parasites.

Changes in physical findings occurred as follows. There was no urticaria or angioneurotic edema observed after treatment was started. The spasm of the upper part of the right rectus abdominis muscle and tenderness upon palpation in this area persisted until 30 cc. of the drug had been given. There was no observable change in the size of the liver and spleen until the second week after cessation of treatment. Since that time neither the liver nor spleen have been palpable on abdominal examination.

This patient is still under observation and remains on a no-duty status. He continues to improve steadily, his only symptoms at the present being a persistent lack of energy and a constant fatigue. However he is now able to perform light duties without excessive fatigue.

The history, physical findings, course, and response to treatment of the other patients closely parallel the case described above except for minor variations. Of interest is the persistence of the symptoms of weakness and fatigue during the period these patients have been under observation.

SYMPTOMS

There was great variation in the intensity of symptoms presented by the individual cases. Each patient was questioned daily regarding his symptoms and was subjected to a physical examination. For a 6 week's period following treatment, the patients were seen twice weekly. The symptoms will be discussed from the standpoint of frequency of occurrence, intensity, and duration.

SKIN MANIFESTATIONS

Pruritus.—Careful questioning as to the occurrence of pruritus at the time of exposure (supposedly when the cercariae enter the skin) revealed six patients who experienced this phenomenon, in one of whom the dermatitis was severe. The pruritus occurred while the patients were in the infested water and subsided in a matter of minutes on leaving the water.

Angioneurotic edema.—Edema occurred in 8 of the 16 patients. The edema was typical of the angioneurotic type. The duration was from 4 hours to 24 hours. It occurred approximately 3 weeks after exposure and was always accompanied by urticaria elsewhere on the body. In one patient the edema was confined to the left infra-orbital region and occurred on only one occasion. In another patient edema of the hands, wrists, eyelids, infra-orbital regions, lower lip, and penis was the first symptom noted. The edema was migratory and would last from 12 to 24 hours, occurring almost daily for 2 weeks in this man. In the other 6 patients the areas of edema were confined to the hands, arms, or face. In all but 1 patient the edema was marked.

Urticaria.—Urticarial wheals with brilliant erythematous margins occurred in 12 patients. They occurred on the abdomen, back, lower extremities, and forearms, and varied in size from 2 cm. to large areas. The duration of the urticaria was from several hours to several days. In 8 instances the urticaria was accompanied by moderate pruritus. In all patients the urticaria occurred daily for a period of 3 weeks, the onset being approximately 6 weeks after

exposure. Urticaria has not occurred in any patient after the completion of treatment. In 3 patients the degree of urticaria was severe.

Erythema.—In two patients an erythema resembling erythema multiforme was observed. In one man the erythema occurred on the trunk and the upper extremities, and in butterfly distribution on the bridge of the nose. The lesion occurred from once to many times daily over a period of 6 weeks and lasted from several minutes to 24 hours. It would fade on pressure. The onset was 4 weeks after exposure. In the second patient the erythema was confined to the trunk and occurred daily for approximately 2 weeks.

CONSTITUTIONAL SYMPTOMS

Weight loss.—Weight loss occurred in 14 patients. The loss, varying from 10 to 50 pounds, was a general one and not regional, but was rapid and progressive, continuing until 40 cc. of the drug had been given. On completion of the course of treatment all patients had gained from 5 to 20 pounds.

Weakness.—All of the patients complained of weakness, six of them being unable to perform the simplest duty. In the remaining patients the weakness was of moderate severity. In all cases it was an early symptom and persisted throughout the course of treatment. There was a gradual return of strength on completion of treatment in all but one patient, although 6 weeks after treatment none of the patients considered themselves normal in this respect.

Fatigue.—Fatigue on slightest exertion was a pronounced symptom in eight of the group. In three men it was moderately severe and in five it was of mild degree. Among the patients in whom this symptom was severe, such simple tasks as writing a letter produced fatigue.

Headache.—Ten patients complained of headache localized to the frontal region. In three the headache was severe, in four moderately severe, and in three it was mild. The headache was an early symptom and occurred over a period of not more than 2 weeks. Each episode persisted from several hours to a day and did not respond to salicylates or codeine. No patients complained of headache after 6 weeks. Only one of the patients had experienced headaches prior to this illness.

Chills.—Three of the patients complained of chills; in one the chill was severe and recurred several times. This symptom was noticed only very early in the disease.

Diaphoresis.—Five patients complained of profuse sweating at night. In no instance was diaphoresis an early symptom. It oc-

curred after treatment had been started and did not last longer than 2 weeks.

PULMONARY SYMPTOMS

Cough.—Thirteen of the group had a cough, which was severe in two instances. Three patients did not have this symptom. In all cases the cough was worse at night and in the severe cases it did not respond to expectorants, sedatives, or codeine. The cough was nonproductive and hacking in character. In one case the cough was accompanied by mild inspiratory dyspnea. This symptom occurred early and subsided gradually after treatment was started. In one instance, on completion of treatment, the cough still persisted in a mild degree.

Chest pains.—Six of the group complained of chest pains. All of these patients also had a cough. The pains occurred during the first 3 weeks of the disease and in all cases subsided with the decrease in the intensity of the cough. The pain is best described as "a sense of constriction." It was not pleuritic or diaphragmatic.

GASTRO-INTESTINAL SYMPTOMS

Anorexia.—This complaint, one of the first, was present in all but two of the patients. In five patients the degree of anorexia was severe. In all patients an improvement was noted after 20 cc. of fuadin had been given, and in all but one patient this improvement has been constant.

Abdominal pain.—Nine patients complained of abdominal pain, mild in character, and described as a "soreness." The location was in the epigastrium overlying the right rectus abdominis muscle. This symptom was among the first noted and persisted until the appetite improved. Abdominal palpation revealed moderate spasm of the right upper rectus abdominis muscle.

Nausea and vomiting.—Five patients complained of nausea. It was moderately severe in one patient. In all patients but one there was concomitant abdominal pain. The symptom was not associated with eating and occurred in the evening along with the rise in temperature. Five patients had one or two mild episodes of vomiting which occurred during the first 2 weeks that symptoms were observed. In two patients who vomited there was no associated nausea.

Diarrhea.—During the first 2 weeks of the disease, five patients complained of diarrhea, but in only one patient were the stools described as watery. The number of stools in 24 hours varied from five to eight, and in no patient did this symptom persist longer than 4 or 5 days.

Constipation.—Nine patients complained of constipation. This symptom was of late occurrence in all of these patients, not being noticed until the middle of the course of treatment. It was not severe or persistent.

GENITO-URINARY TRACT SYMPTOMS

None of the patients had very severe urinary tract symptoms. The symptoms occurred early in the disease and did not recur. In all the patients urinalysis before, during, and after treatment yielded negative results. Only one patient complained of urinary symptoms after treatment was begun.

Nocturia and frequency.—Six patients complained of nocturia two or three times nightly during the first 4 weeks of the disease, and four patients complained of frequency of urination (from eight to ten times daily); three of the latter also had nocturia.

Dysuria and hematuria.—Two patients complained of dysuria; these patients also had frequency and nocturia. No patients had hematuria.

MUSCULOSKELETAL SYMPTOMS

Stiff neck.—Seven patients complained of stiff neck. In three the symptom was severe and existed over a 10-day to 2-week period during the first 4 weeks of the disease. In none of these patients was there nuchal rigidity or glandular enlargement. Spasm of the sternocleidomastoid muscle was marked.

Backache and other myalgias.—Eight patients noticed backache localized in the lumbar region. The symptom occurred at night with the evening elevation of temperature and was relieved on rest. This symptom was an early manifestation and did not persist after the patients became afebrile. Pains in various muscle groups of the body were described by nine of the patients, and were severe in three. This complaint was an early manifestation and occurred at the time of the evening temperature elevation.

Arthralgia.—Six patients complained of pains in the large joints of the body (wrist, hip, ankle, elbow, and shoulder). This symptom was noted after treatment was started and lasted approximately 1 week. The arthralgia was of moderate severity and migratory in character. No objective changes in the joints were noted.

MENTAL AND NEUROLOGIC SYMPTOMS

Vertigo.—Twelve patients complained of mild vertigo. In four patients the symptom occurred at the onset, was mild in character and lasted approximately 24 hours. It did not recur later in the

course of the disease. In the remaining eight patients, mild vertigo on one or two occasions was noted at the onset, but the symptoms recurred with increased intensity during the middle of the course of treatment, and although not marked, persisted for from 7 to 10 days after treatment was completed. Four patients have never experienced the symptom.

Sensory paresthesia.—In 12 of the group sensory paresthesia was noted. This manifestation occurred near the end of the course of treatment and was of moderate severity. All 12 patients complained of "creeping sensation" all over the body which was most marked at night but did occur during the day. This symptom lasted approximately 2 weeks after the completion of treatment and subsided gradually.

Insomnia, depression, irritability, and anxiety.—In 10 patients there was noted a mild degree of insomnia, depression, irritability, and anxiety. In only 1 of the 10 had nervous symptoms been noted prior to the onset of the disease. The onset of these symptoms was early and they persisted in mild degree throughout the course of treatment, subsiding gradually.

Tremor.—Thirteen of the group complained of a coarse tremor of the fingers. This symptom was noticed during the course of treatment and occurred approximately 8 or 10 hours after the injection of the drug. The symptom persisted after the course of treatment in only three of these patients.

PHYSICAL FINDINGS

In six patients there was evidence of recent weight loss with decrease in the elasticity of the skin. In all 16 patients there was an evening temperature elevation. The elevation most frequently occurred around 1900 and lasted approximately from 4 to 8 hours, the elevation ranging from 99° to 104.2° Fahrenheit. Morning temperatures varied from 98.6° to 100° Fahrenheit. The typical temperature curve obtained is best described as saddleback. In all patients the temperature returned to normal after 40 cc. of fuadin had been given. Temperatures were recorded twice daily until 6 weeks after the completion of treatment. Three patients showed spasm of the sternocleidomastoid muscles as described under symptoms. The chest was normal in all but one patient, who had moist râles in the left lung associated with a cough and temperature elevation for a period of 1 week, 7 weeks after onset of the disease. In 11 of the patients there was moderate spasm of the upper portion of the right rectus abdominis muscle associated with tenderness to palpation in this area. This finding was present

at the time of the first examination and persisted for a period of from 4 to 6 weeks.

At the time of the original examination in five patients the liver was palpable 2 cm. below the costal margin. The liver edge was smooth, rounded and nontender. There was no "upward enlargement" as tested by percussion. In one patient the liver did not become palpable until 7 weeks after the onset of symptoms; in all but one it has remained palpable after treatment.

Seven patients had a palpable spleen. The splenic enlargement was not great, the examiner being able to palpate the tip of the spleen 1 or 2 cm. below the costal margin. In three of these patients splenic enlargement was not noted until 1 week after treatment was begun. In four cases the splenic enlargement has persisted.

No abnormalities of the external genitalia were noted except one instance of transient edema of the penis and scrotum. Thrombosed hemorrhoids were found in five patients. These patients had never noticed symptoms prior to the disease and no mention of hemorrhoids had been made on previous physical examinations. No neurologic abnormalities were noted.

LABORATORY EXAMINATIONS

Red blood cell counts and hemoglobin determinations were normal in all patients. White blood cell counts and differential counts were performed on all patients as follows: Before treatment was started, after 20 cc. of the drug had been given, on completion of treatment, and 3 weeks following treatment. In some patients weekly leukocyte counts and differential examinations were made. Fourteen patients had a leukocytosis. The leukocyte counts ranged from 6,950 to 20,350. All patients showed an eosinophilia, the degree ranging from 6 percent to as high as 87 percent. In 12 patients there was a decrease in the leukocytosis on completion of treatment, and in 13 the degree of eosinophilia had decreased on completion of treatment but still persists 6 weeks after treatment. In one patient there was a recurrence of *Schistosoma japonicum* in the stools.

* Stool examinations after the diagnosis was established were made as follows: One examination after 20 cc. of the drug had been given; three examinations after 40 cc.; two stool examinations 1 week later; and five stool examinations at the end of the third week following treatment. In those patients receiving 70 cc. of the drug an additional five specimens were examined 4 weeks after completion of treatment. Monthly examination is contem-

plated of five consecutive stools for *Schistosoma japonicum* for a period of 6 months in all patients and then five specimens once every 3 months for 1 year.

In 1 patient the schistosoma was not found in the stools until 6 specimens had been examined; in 4 patients the ova was present in the fifth specimen submitted, in 2 the fourth, in 5 the third and in 3 the second. In 1 patient 17 stool examinations were made before a positive specimen was discovered. All other stool examinations of all patients except one have been negative for ova of *Schistosoma japonicum* 6 weeks after completion of treatment. One patient had stools positive for schistosoma 24 days after completion of his course of treatment. Urinalyses on all patients before, during and after treatment yielded negative results.

TREATMENT

For purposes of treatment the patients were divided into two groups. The first group comprised 10 men; they received 40 cc. of fuadin by intramuscular injection into the buttocks. The second group, composed of 6 men, received a total of 70 cc. of the drug by the same method. Injections were given every other day. The first injection was 1.5 cc., the second 3.5 cc., and the subsequent injections 5 cubic centimeters.

In all the patients, after the fifth injection (20 cc.), there was noted a general improvement as evidenced by increased appetite. No skin manifestations were observed after 10 cc. of the drug had been given. Weight gain in all but one patient began after 40 cc. of the drug was given, and has been maintained. Three weeks after completion of therapy, weight gains of from 5 to 20 pounds have been observed. There was no striking amelioration of weakness and fatigue.

No serious untoward effects, either local or systemic, were observed during or after treatment, except perhaps for minor tremors of the hands and, in one instance, profuse diaphoresis. Since completion of treatment five patients have complained of falling hair. This symptom has not been observed in a large series of cases under observation and treatment at Army hospitals on this island.¹

RECURRENCES AND COMPLICATIONS

In this series, 6 weeks after Group 1 completed treatment, one recurrence has been noted. In this case treatment was started 5 weeks after the onset of symptoms, the patient receiving 40 cc.

¹ Personal communication from Lieutenant Colonel Walter L. Winkenwerder, M.C., A.U.S.

of fuadin. Two stool examinations made after 20 cc. of the drug had been given yielded negative results, as did three stools on completion of treatment, and two stools 1 week later. At the end of the third week following treatment three stools were negative but the fourth, fifth and sixth stool specimens contained the ova of *Schistosoma japonicum*. The patient showed clinical improvement while undergoing treatment and there has been no recurrence of symptoms. Weight gain has been maintained. This man is receiving another course of the drug (70 cc.).

These patients have been remarkably free from respiratory infections and there have been no superimposed infections of the gastro-intestinal tract, although mild infections of this type have been prevalent in this area. One patient had a hookworm infection and two showed ova of *ascaris* in their stools.

COMMENT

The 16 cases of schistosomiasis presented here all showed acute symptoms of moderate severity. Experience in Army hospitals on this island with a large number of cases reveals that these cases do not give a complete picture of the variation in clinical symptoms. The cases presented represent those of moderate severity which form approximately 30 percent of the cases seen to date on this island; cases with mild symptoms comprise approximately 50 percent; the severe and the asymptomatic 10 percent each. Temperature elevation which occurred in all 16 cases is not a constant finding in schistosomiasis.

Neurologic manifestations occurred in a small percentage of the cases seen on the island. In some of these cases cerebral symptoms with disorientation, associated involvement of the pyramidal tracts manifested by hyper-reflexia, spasticity, clonus and bilateral Babinski reactions occurred. Monoplegias and hemiplegias have been observed. Sensory changes, principally scattered paresthesias, have been present. All of the neurologic manifestations were noted early in the acute phase of active symptoms. Definite improvement without recovery was observed in the short period of time these cases were under observation.

The course of infection with *Schistosoma japonicum* has been divided into three stages.

1. The period of incubation, which is defined as the period between invasion and the first appearance of eggs in the feces. During this 6- to 10-week period the acute symptoms are manifested.

2. The period of egg deposition and extrusion is characterized by daily fever, anorexia, epigastric pain, loss of weight, and dysen-

tery with eggs in the stools. In this small group of cases dysentery was not marked. Secondary anemia is described in this period but has not been observed in this group of cases. Leukopenia was not a finding. Liver and splenic enlargement, which occurs during this period, was not great in any of these patients.

The pathologic picture produced in the liver is caused by the deposition of eggs in the liver tissues, each egg being surrounded by a layer of concentric white cells, principally eosinophils. This is the so-called schistosomiasis abscess. In the liver there may be found many small abscesses which frequently coalesce to form larger lesions. Encapsulation takes place with concomitant destruction of the liver tissue. These abscesses also are found in all layers of the small intestine, the lungs and the brain. Splenic enlargement is due to congestion accompanying the liver damage.

3. The period of tissue proliferation and repair occurs late in the disease and only in untreated cases. In this stage great thickening of the intestinal wall with scar formation develops, and cirrhotic changes in the liver are manifest, with ascites and edema of the extremities. In this period the victim often succumbs to *soma japonicum* in the stool specimen.

It is believed that the prognosis in the patients whose cases are reported here is good. They will be carefully observed, with frequent stool examinations, for evidence of recurrence. The parasite does not multiply in the human body, and the severity of the case is dependent upon the number of cercariae that enter the skin at the time of exposure. In this series the period of exposure was short.

Another factor influencing prognosis is the stage of disease in which therapy is initiated. Early treatment augurs a good prognosis. In this group, therapy was begun in each case the day after the diagnosis was established on finding the ova of *Schistosoma japonicum* in the stool specimen.

From the military standpoint the disease must be considered a serious one. It incapacitates the individual from full performance of duty for a period of several months. The symptoms of weakness and fatigue persist long after therapy is completed and when no evidence of active disease exists. Attempts to return eight patients of this group to full duty 4 weeks after completion of treatment met with failure because of the symptoms of weakness and fatigue.

SUMMARY AND CONCLUSIONS

1. Sixteen young, previously healthy, enlisted personnel became infected with *Schistosoma japonicum*, the disease being diagnosed

clinically in all but one patient and confirmed by the finding of the ova in the stools.

2. All of the group gave a history of wading or swimming in waters known to be infested.

3. All cases were treated by intramuscular injection of fuadin, a trivalent antimony compound. The response to therapy has apparently been adequate in all but one case.

4. After 6 weeks' observation following treatment, there has been one recurrence as evidenced by positive stool. This patient will be subjected to another course of treatment with fuadin.

5. The course of treatment recommended is a total of 70 cc. given by intramuscular injections in the gluteal regions every other day. No serious untoward effects of the drug have been observed.

6. The symptoms of the disease as evidenced by this group of patients are varied. Common findings early in the disease are skin manifestations, anorexia, weakness, and fatigue. There was usually an elevation of the leukocyte count and in all cases an eosinophilia was found, which persisted after treatment.

7. The prognosis in these patients is believed to be excellent, but from the military standpoint the disease must be considered a serious one because of incapacity for duty over an extended period of time.

8. The most important factor in the consideration of the disease is prevention. The symptoms of the disease and the mode of infection should be widely publicized among all personnel. In areas where the disease is known to be endemic, careful surveys of the waters in the region should be made. Signs should be posted warning of the presence of the infestation. Adequate bathing and laundry facilities should be established in all areas where men must live.

9. Men who have contracted the disease should be observed at frequent intervals for at least 1 year following exposure. Stool examinations should be made once monthly for a 6-month period, and then every 3 months for 1 year. Since personnel that contract the disease will return to full duty, medical officers should familiarize themselves with the symptoms and course of the disease and be on the lookout for recurrences in the known cases or suspect the disease in men who have a history. Treatment should be instituted immediately on establishing the diagnosis.

MODIFICATION OF FAUST-MELENEY TECHNIC

FECES EXAMINATION FOR SCHISTOSOMA JAPONICUM

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The diagnosis of schistosomiasis is becoming increasingly important in the Pacific theater and as new areas are opened up will be even more so. A number of methods for the identification of ova of *Schistosoma japonicum* have been used; these include direct smears, sedimentation, and concentration technics. Direct smears have the disadvantage of using only a very small sample of the specimen, with consequent false negative results. Sedimentation technics have been more successful, and recently Mathieson has reported a modified acid-ether method that is stated to give a high concentration of ova. This latter process uses about one gram of feces as a sample.

Andrews,¹ working with *Schistosoma japonicum*, has stated that 39 percent of positive stools will show by direct smear, 67 percent by using a sedimentation technic, and 100 percent by the Faust-Meleney technic. The latter technic is carried out as follows: The whole stool is washed with 2 liters of normal saline solution, and then passed through a mesh sieve and poured into an Erlenmeyer flask. It is left to sedimentate for 30 minutes and the supernatant fluid is siphoned off. This process is repeated until the fluid is clear. The container is then filled with tap water and left overnight. The next morning the contents are examined with a hand lens for the presence of miracidia. These are seen as minute, white, boat-shaped bodies swimming rapidly in a straight course, and most numerous just under the surface pellicle of the water. This technic has the advantage of using a whole stool and the disadvantage of being a somewhat cumbersome and time-consuming procedure.

A modification² of the Faust-Meleney method has been devised and is giving results in the field which are superior to the microscopic methods of smears and sedimentation. The method requires

¹ ANDREWS, M. N.: Examination of faeces for ova of *Schistosoma japonicum*. Chinese M. J. 49: 42-46, January 1935.

² This method was evolved in conjunction with work done on schistosomiasis by Epidemiology Unit No. 18.

but little equipment, uses a large sample of feces, and consumes relatively little time.

From 20 to 30 gm. of feces is thoroughly emulsified with water in a beaker, the total quantity being about 100 cubic centimeters. After being filtered through two thicknesses of gauze, it is allowed to settle for about an hour. The supernatant fluid is siphoned off and the residue is used for the remainder of the test.

A piece of 8-mm. glass tubing is flared at one end under heat. (This is easily done by using a nail held in pliers and rotating the hot glass around the nail which is inserted partway into the bore.) A small funnel is then formed, the diameter of which should be small enough so that the finger may be used as a stopper. The tube is cut but left long enough so that the flared end will be a few centimeters above the top of a 1,000-cc. Erlenmeyer flask when the other end rests on the bottom.

An Erlenmeyer flask is filled to within 7 cm. of the top with tap water and is allowed to stand for at least 15 minutes to obviate any currents. The tube is placed in the flask and the fecal emulsion is then very carefully and slowly poured down the tube, agitation being avoided. A small piece of gauze is held around the tube to catch any accidental overflow. If done correctly the emulsion will lie smoothly on the bottom with no more than a centimeter of cloudy water above it. When all the emulsion has been poured, the tube is slowly rinsed out with about 15 cc. of water, is then raised a few centimeters, the flared end is stoppered with the finger, and the tube is carefully withdrawn. If the flask is not completely filled, additional water should be dropped into it. The flask is then covered and examined for miracidia in about 18 hours. This procedure may be done with 500-cc. flasks, using a smaller amount of feces.

It must be emphasized that agitation must be scrupulously avoided and that there should be no floating particles. Unless the upper column of water is absolutely clear, the miracidia will not rise to the surface where they can be seen.

If a microscope lamp is available, greater visibility will be obtained by directing the beam of light horizontal to the water surface. The organisms can be seen with the naked eye, but a hand lens is of considerable aid.

Faust and Meleney³ have pointed out that the miracidia of *Schistosoma japonicum* swim in a straight line until an object is struck, when they go off in another straight line. This character-

³ FAUST, E. C., and MELENEY, H. E.: Studies on Schistosomiasis japonica. Am. J. Hyg., Monograph Series No. 3, 1924.

istic differentiates them from free-living flagellates which swim an irregular or aimless course.

It would be expected that schistosomiasis due to *Schistosoma haematobium* and *Schistosoma mansoni* might be diagnosed in a similar way. The ova of opisthorcoid and heterophyoid species of trematodes hatch only after ingestion by the proper molluscan, host, hence the miracidia of these species cannot be confused with those of *Schistosoma japonicum*. According to Craig and Faust⁴ the ova of *Fasciola hepatica*, *Fasciolopsis buski*, *Paragonimus westermani* and *Echinostoma ilocanum* develop into miracidia after deposition in water, but, depending on the species, require from 6 days to 7 weeks for this transition.

The laboratory procedure described is therefore specific for the diagnosis of schistosomiasis.

⁴ CRAIG, C. F., and FAUST, E. C.: Clinical Parasitology. 3d edition. Lea & Febiger, Philadelphia, 1943. pp. 342-416.



BACTERICIDAL ACTION OF PENICILLIN

The oxygen uptake of staphylococcal suspensions in different phases of their culture cycle has been measured in the presence of penicillin. During the "resting" phase even large concentrations of penicillin have no effect on the rate of oxygen uptake. During the early lag phase and the logarithmic phase of multiplication, penicillin exerts a strong inhibitory effect on and eventually completely stops the oxygen uptake of the suspensions in very small concentrations (0.04 to 0.1 unit per cc.). The effect is not immediate but sets in after an induction period.

Hemocytometer and viability counts run in parallel with the measurements of oxygen uptake show that penicillin has a strong bactericidal effect on staphylococcal suspensions in the early lag phase and the logarithmic phase of multiplication but no measurable bactericidal effect during the resting phase. Penicillin is capable of exerting a bactericidal effect on the staphylococcus before actual cell division has occurred. On the other hand staphylococcal suspensions can go through at least one division in the presence of penicillin when this is added during the logarithmic phase of multiplication.—MUTCH, N., and REWELL, R. E.: Penicillin by inhalation. *Lancet* 1: 650-657, May 26, 1945.

OBSERVATIONS ON TSUTSUGAMUSHI DISEASE

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Opportunity was recently presented for observation of 47 cases diagnosed as tsutsugamushi disease. The facilities for a comprehensive review of the literature at this forward activity were necessarily limited. However the clinical and the epidemiologic picture as presented in this series of cases has several interesting and significant variations from the available descriptions of the disease.

EPIDEMIOLOGY

These cases occurred on a tropical island about 5 square miles in area. The island is almost entirely coral, with a small area of sandy beach. The terrain is quite rough, and prior to American occupation the portion used by the Navy was entirely covered by a dense tropical rain forest. No cleared areas, native gardens, or kunai grass regions were found within $\frac{1}{2}$ mile of the area.

Immediately after occupation the camp and supply dump areas were almost completely cleared of trees. The usable wood was cut into lumber, the rest pushed into large windrows for disposal.

Several species of rats were found, the most numerous being *Rattus norvegicus*, *Rattus rattus alexandrinus*, and *Rattus exulans*. Nearly every rat caught was heavily infested. The ears were most frequently parasitized, but the nose, cheeks, and inguinal region were occasionally sites of attachment.

The taxonomy of the mites is uncertain, but *Trombicula fletcheri* and *T. minor* have been taken in largest numbers. No *T. deliensis* or *T. akamushi* were found. *Trombicula* mites were taken from rodents, bandicoots, dogs, and all gallinaceous birds collected. Wild pigs and arboreal birds have not been parasitized. Bats are infested with *Myotrombicula vespertilionis*.

Collection of free living larvae showed that the mites remain in the soil and leaf mold until attracted by a host. Experiments indicated that persons continually on the move are relatively safe from attack; those resting a few moments are quickly parasitized.

The number of mites in an area was determined by trapping rats. The value of clearing was demonstrated by this means. Those rats taken from camp and supply dump areas were relatively clean, while those from densely forested areas were heavily infested. No appreciable effect on the mite population was produced by spraying with 10-percent DDT in oil.

The activity of the men during working hours had little influence on the infection rate. Forty-seven percent of all cases occurred among aviation personnel who seldom went into uncleared areas during working hours. Only 29 percent of the cases occurred among men on general duty who worked in uncleared areas. The latter group was almost twice the size of the former.

A much better correlation was established between the proximity of the living quarters to uncleared areas. Two factors operated here: Activity during leisure time, and location of air-raid shelters. It was almost impossible to dig foxholes because of the hard coral, so men close enough to uncleared areas sought shelter during air raids behind logs, large trees or depressions or simply by lying prone. Those in the middle of the camp area constructed shelters of sandbags or barrels on land previously cleared. During the stress of an air-raid alert few men took time to dress adequately, so clothing regulations were of little value.

CLINICAL ASPECTS

The onset of tsutsugamushi disease has been described by previous observers as abrupt. In this series all cases had a very gradual onset, in which a definite transition from prodromal period to incipency of the disease could not be ascertained. This period of onset was characterized by general malaise, a postocular headache of daily increasing severity, and an occasional low-grade evening elevation of temperature. The men were usually handled as out-patients during this period, and were not referred to the hospital until the appearance of a lymphadenopathy and persistent fever. This was usually from 3 to 7 days from the onset of symptoms. It was therefore impossible to establish any given day of onset.

All cases presented a symptom triad consisting of (a) remittent fever, (b) severe postocular or supra-orbital headache, and (c) a marked bilateral inguinal lymphadenopathy.

The febrile reactions varied considerably, with maximal temperatures ranging from 100.4° to 106° F. (graph 1). The average maximal temperature was 103.6° Fahrenheit. The average number of febrile days was 12.7. It was frequently found that afebrile patients, when first allowed moderate activity, developed a mod-

erate evening temperature rise to not more than 100° F. which persisted for from 1 to 3 days.

An interesting variation in the febrile reactions occurred in three instances. These patients developed intermittent febrile periods of from 1 to 3 days, but with the maximal temperature never ranging above 102° F. (graph 2). This group showed more debility and apparent cardiovascular involvement than did many patients with higher temperatures of the more typical febrile reaction.

All patients presented supra-orbital or postocular headache, both as a prodromal symptom and as a characteristic of the disease. This was frequently associated with photophobia and pain on ocular movement. In the entire series no disturbances of vision were reported.

Inguinal lymphadenopathy was a universal finding. Frequently associated with this was femoral adenopathy. In an occasional case a transient cervical or axillary involvement was noted. The adenopathies at the various locations exacerbated and remitted independently of one another. An exacerbation of an inguinal group frequently followed an increase in physical activity.

There are two symptoms attributed to tsutsugamushi disease which were not found in this series. Auditory disturbances were not experienced. No delirium or other mental disturbances were apparent, except brief periods of apathy associated with general malaise and hyperpyrexia.

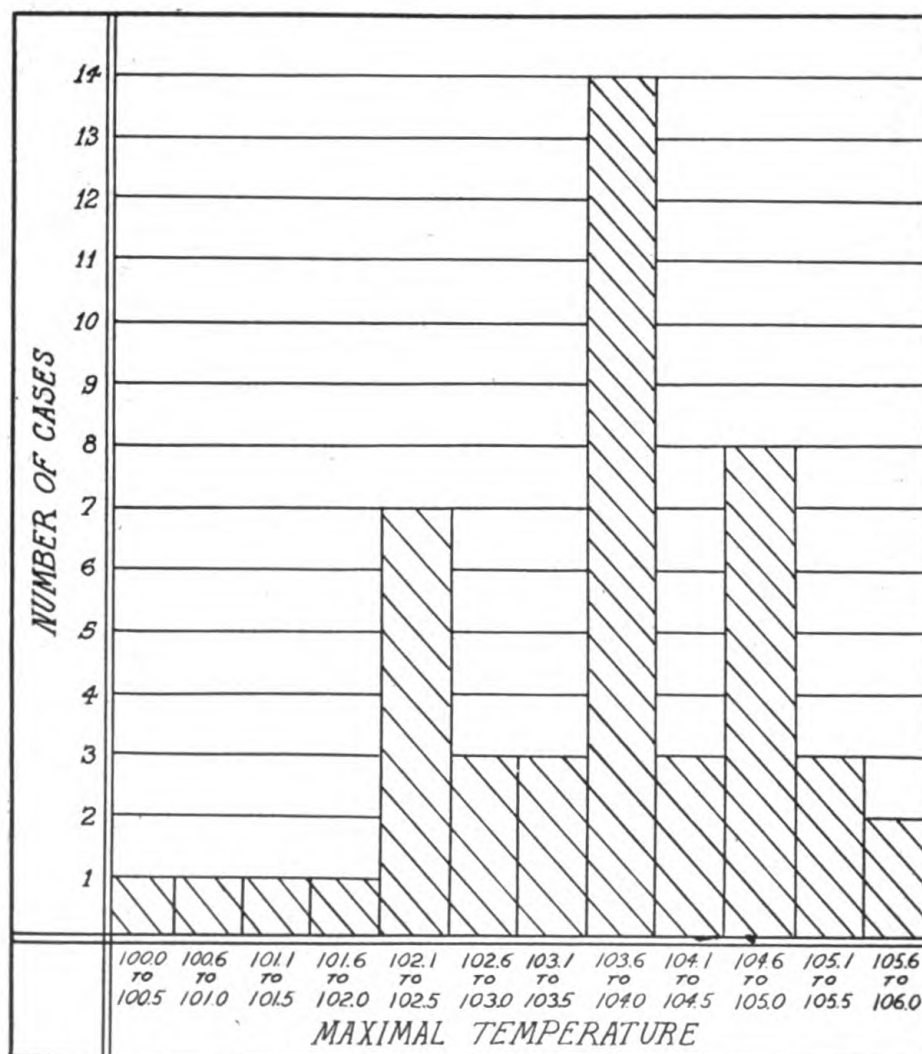
A primary ulcer due to the bite of the mite was found in 36 percent of the cases. The site of this lesion was usually the inguinal area or about the ankles.

In only 7 percent of the cases in this series was the maculopapular rash found. This appeared during the first week of hospitalization and persisted for from 3 to 7 days.

All the patients in this series developed upper respiratory symptoms of various degrees. Most commonly this consisted of a moderate dry cough, gradually diminishing until complete disappearance during the third hospital week. No pneumonic complications were observed.

The Weil-Felix reaction with the OXK strain of *Proteus vulgaris* was studied on all patients suspected of having the disease except three cases handled before the service was available. A progressively rising titer, or one of 1:80 or higher, was considered of diagnostic significance. Three patients developed a titer of 1:640. Two patients with a titer of only 1:40 were evacuated before further studies could be made.

A troublesome problem in diagnosis was encountered in four



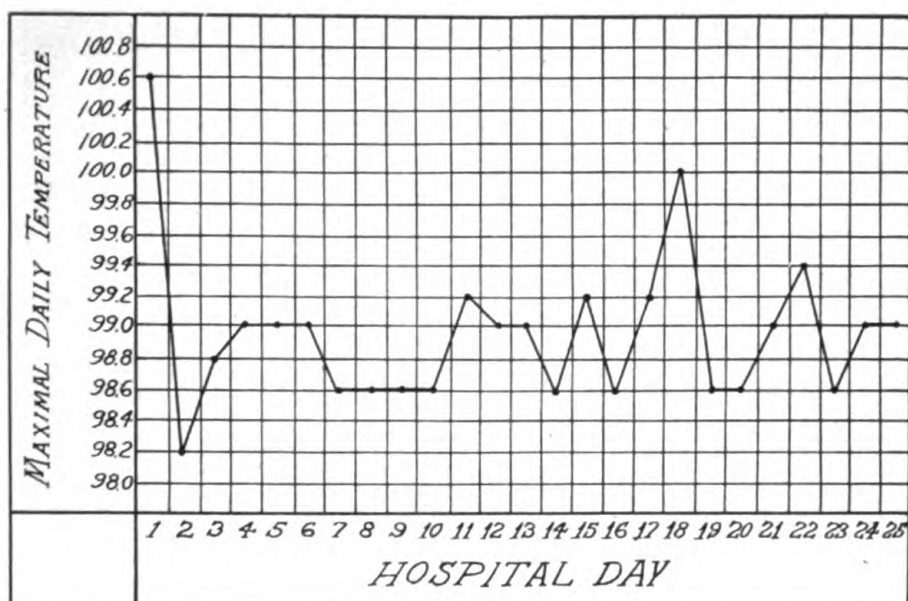
GRAPH 1.—Distribution of maximal temperature.

cases in which the titers failed to rise until after the twentieth day. In two of these patients the mild clinical symptoms, which disappeared within 10 days, and the negative OXK reactions led to an erroneous diagnosis and discharge of the patients on the fourteenth day. Within a week they reappeared at the hospital with an elevation of temperature and the titers of both were then found to be 1:160.

Complete blood counts (made on all patients) were within normal limits.

No deaths occurred in this series of cases.

The problem of sequelae could not be adequately evaluated. During the first 2 months patients were evacuated as quickly as the acute symptoms subsided. Of 16 patients, 7 were returned to duty between their fortieth and fiftieth hospital days. The remainder were evacuated because of sequelae. The former group



GRAPH 2.—Usual type of febrile reaction. OXK agglutination in this case, 1:160. Patient evacuated on twenty-fifth hospital day.

demonstrated an interesting improvement in periodic exercise tests, which rapidly approximated normal. The latter group showed a continued state of debility, with apparent cardiovascular involvement, as evidenced by abnormal increase in pulse rate on change of position, poor response to exercise tests, and a continued abnormally low blood pressure. Two of these patients had repeated episodes of precordial pain. Two developed extrasystolic phenomena further aggravated by exercise. The entire group experienced dyspnea on exertion. No pulmonary or dependent edema developed.

SUMMARY AND CONCLUSIONS

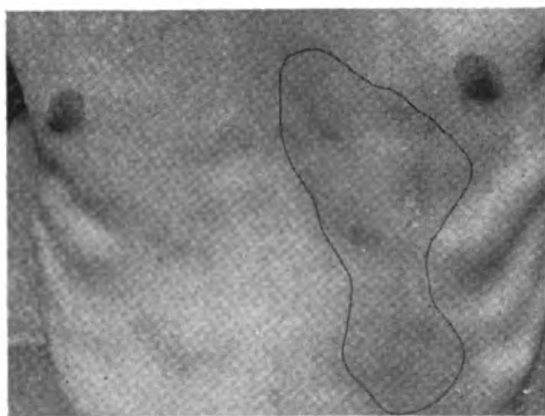
1. Forty-seven cases of tsutsugamushi disease are reported.
2. These cases were not associated with overgrown cleared areas, native gardens, or kunai grass regions as reported for other outbreaks.
3. Rats are apparently the important reservoirs.
4. Mites remain in leaf mold or soft earth until attracted by host stimuli.
5. Occupation had little effect on the incidence of disease, but location of living quarters was important.
6. Characteristic of this series are the following interesting and significant variations from the available descriptions of the disease.
 - A. A gradual onset.
 - B. Unusual febrile reactions in three cases.

- C. Remissions and exacerbations of adenopathies in various glandular groups.
- D. Absence of visual, auditory, and mental symptoms.
- E. Low incidence of rash occurrence.
- F. A delayed rise in the titer of the Weil-Felix reaction in four instances.
- G. No deaths in the entire series.
- 7. A description of sequelae suggestive of cardiovascular involvement is presented.
- 8. It is believed that this series of cases represents a milder form of tsutsugamushi disease than has been reported previously.



TRAUMATIC SEPARATION OF RIBS AND COSTAL CARTILAGES

A Naval aviator used to wear his .38 gun in a holster slung from his right shoulder so that the gun rested over the left side



of his chest near the anterior axillary line. In so doing the left anterior supporting strap of his parachute ran directly over the gun. On being required to abandon his plane during a recent combat mission he had to take to his parachute. Pulling

his chute cord as soon as he was free of his plane, the opening force was so great that it pressed the gun into the pilot's left anterior chest wall, separating the sternal cartilages from their rib attachments. The third, fourth, fifth and sixth ribs were involved. Six weeks later the ribs were still depressed into the thorax so that the cartilage overrode the ends. There were no abnormal physical signs within the chest or in the related circulatory system and roentgen studies of the chest were essentially normal except for the noted abnormality of the costochondral rib junction.—BIERMAN, H. R., Lieutenant Commander (MC) US.N.R.

STERNAL PUNCTURE IN DIAGNOSIS OF MALARIA

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It is a common experience to find that in some cases of clinically typical malaria, the morphologic diagnosis cannot be established even from technically adequate thick blood smears. This difficulty is even more frequently encountered in patients presenting atypical symptoms. In a small proportion of patients, the ring forms alone do not permit an accurate determination of the species of plasmodium.

The malarial parasite undergoes development in the bone marrow as well as in other organs. Only in recent years, however, has this fact been utilized in diagnosis.^{1, 2}

As a source of bone marrow the sternum presents the most readily available material. The instrument used for sternal puncture is a simple 16-gage stainless steel needle, 1½ inches long, fitted with a stylet, the tip ground to a short bevel. Under surgical asepsis 1-percent procaine is infiltrated into the skin, subcutaneous tissue, and periosteum, over a point in the midline of the sternum, at a level approximately halfway between the second and third ribs. The needle is introduced in a vertical direction, perpendicular to the long axis of the sternum, down to the bone. Then the needle, still maintained vertically, is rotated with pressure until the tip is felt to penetrate the anterior table of the sternum. This penetration is usually painless. When the needle is rigidly fixed it is certain that the tip extends into the marrow cavity. The stylet is then removed, and with a 1-cc. or a 2-cc. syringe, approximately 0.25 cc. of marrow fluid is aspirated. This aspiration is usually accompanied by acute, localized, transient pain. The stylet is then reintroduced, the needle rapidly withdrawn, and pressure is exerted by an assistant over the puncture wound for several minutes, until oozing has ceased. From the marrow fluid thin smears are made.

¹ AITKEN, G. J.: Sternal puncture in diagnosis of malaria. *Lancet* 2: 466-468, October 16, 1943.

² RUMBALL, C. A.; PARSONS-SMITH, B. G.; and NANCEKIEVILL, L.: Sternal puncture in diagnosis of malaria. *Lancet* 2: 468-469, October 16, 1943.

The marrow smears are dried in the incubator at 37° C. for 30 minutes. They are stained with Wright's stain for one minute, then immersed in Giemsa stain for 30 minutes, and differentiated in distilled water, with observation of the color at frequent intervals under the microscope. The smears are dried and are examined under the oil-immersion objective.

From preliminary scanning it is observed that marrow preparations containing free blood pigment or granules of pigment in phagocytic cells are most likely to reveal malarial parasites. The presence of schizonts or of gametocytes is unequivocal evidence of malaria. But in their absence the criterion for diagnosis is the observation of intracellular ring forms consisting of definite cytoplasm and chromatin dot. Malarial parasites may, at times, be simulated by Howell-Jolly bodies, or by atypical bone-marrow (giant) platelets. Each preparation is examined at least 20 minutes before being pronounced negative.

The laboratory material at this South Pacific fleet hospital, situated in a hyperendemic malarious region, was obtained from Naval and Marine personnel, many of whom had been exposed to malaria for over 2 years. Sternal puncture was performed on a total of 90 patients.

Group 1.—This group comprised 13 patients, none of whom had had a previously established diagnosis of malaria, and who, at the time of examination, exhibited clinically typical malaria. In all of these patients, from 2 to 4 thick blood smears, many obtained after the administration of epinephrine, had been negative prior to the bone marrow examination. Most of the successive smears were taken at intervals of 24 hours. The majority of these patients had been on routine atabrine suppression therapy prior to admission. Ten of these 13 patients showed the presence of vivax parasites in the bone marrow, and 1 the presence of falciparum parasites. In 3 of these 11 cases the sternal puncture was performed after the institution of treatment. All but one responded typically to routine treatment with either atabrine or quinine. In several instances thick blood smears examined during treatment were positive.

In 2 of the 13 cases of this group the bone marrow was recorded as negative. These cases likewise responded to treatment.

Group 2.—This group comprised 49 patients, none of whom had had a previously established diagnosis of malaria, and who exhibited clinically atypical symptoms or signs. Each of these patients presented one or more of the following manifestations: Various types of fever, unexplained frontal headache, obscure splenomegaly, nausea and vomiting, and myalgia. In all patients,

from 2 to 4 thick blood smears were negative, prior to the bone marrow examination. Most of the successive smears were taken at intervals of from 24 to 48 hours. The majority of these patients had not been on routine atabrine suppression therapy prior to admission. Ten of these 49 patients showed the presence of vivax parasites in the bone marrow. Nine of these 10 patients were treated with either atabrine or quinine and 7 of the 9 treated cases responded satisfactorily to treatment.

Of the 39 patients yielding negative bone marrow findings, the majority were treated with atabrine with no change in the clinical manifestations. In these cases thick blood smears examined during treatment remained uniformly negative.

Group 3.—This group comprised 15 patients, each of whom presented typical or atypical clinical manifestations of malaria. In each of these cases ring forms were observed in thick blood smears, but the diagnosis of the species remained in doubt. In 8 cases the presumptive diagnosis of *Plasmodium vivax* in the blood was confirmed by the presence of schizonts or of gametocytes of *P. vivax* in the bone marrow. In 1 case of presumptive *P. vivax* in the blood the bone marrow exhibited *P. falciparum*. In 1 case the presumptive finding of *P. falciparum* in the blood was confirmed in the bone marrow. In 2 cases the presumptive findings in the blood of *P. vivax* and *P. malariae*, and of *P. vivax* and *P. falciparum*, respectively, were likewise confirmed in the bone marrow. In 2 cases the parasites in the blood were of undetermined type; the bone marrow disclosed *P. vivax* in one, in the other *P. vivax* and *P. malariae*. In 1 case in which *P. vivax* was found in the blood the bone marrow failed to reveal any parasites.

Group 4.—This group comprised 13 patients, each of whom had had from 1 to 15 established attacks of malaria, during periods ranging from 1 month to 2 years prior to admission. At the time of examination none of these patients were suffering paroxysms of malaria. In all of them thick blood smears were negative. In 4 of these 13 cases the bone marrow revealed the presence of *P. vivax*. The remaining bone marrow examinations yielded negative results.

COMMENT

The desirability of establishing the diagnosis of malaria by morphologic evidence is universally accepted. From the point of view both of accurate treatment and of completeness of the patient's health record, every effort should be made to demonstrate the parasite.

It is evident that examination of the sternal bone marrow yields information which increases the chances of an accurate diagnosis

of malaria. Two reservations, however, deserve emphasis. In the first place, as evidenced by the two Group 1 cases with negative bone marrow findings, in a small minority of patients actively ill with presumptive malaria the condition may remain undiagnosed. In the second place, as indicated by the data among the patients in Group 4, the finding of parasites in the bone marrow in a person known to have had malaria previously may have no bearing on the patient's current illness. Malarial parasites have been known to lurk in the bone marrow for many years. Two examples of this have been observed by one of the authors (H.K.R.), when *P. malariae* was transmitted by blood donation 15 and 25 years, respectively, after contracting the disease. During the interval the donors had experienced no clinical symptoms of malaria. Sternal puncture is not indicated, therefore, among patients in whom the diagnosis of malaria has been previously established.

Because of the simplicity of the method of bone marrow examination and the important diagnostic information that it yields in selected cases, the present authors recommend the more widespread use of this procedure in Naval medicine.

SUMMARY

1. The importance of a morphologic diagnosis of malaria is emphasized.
2. A simple method for the examination of the sternal bone marrow in the diagnosis of malaria is described.
3. In properly selected cases the bone marrow examination increases the chances of an accurate diagnosis of malaria.



TEST FOR URINARY BILIRUBIN

When 2 drops of Löffler's methylene blue are added to 10 cc. of urine containing bilirubin, the urine turns a brilliant green. However any sufficiently yellow liquid or urine, whether containing bilirubin or not, will give a "positive" test. The methylene blue test merely substitutes for the problem of whether a urine is more or less yellow. Unfortunately for the usefulness of the test in the clinic, bilirubin is only one of several substances which may impart, when present in sufficient concentration, a yellow color to normal or pathologic urines.—WATSON, J.; MEADS, M.; and CASTLE, W. B.: Tests for urinary bilirubin. *J.A.M.A.* 128: 308, May 26, 1945.

EYE INJURIES AND DISEASES ENCOUNTERED DURING IWO JIMA CAMPAIGN

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This is a report of a large portion of the eye cases seen on Iwo Jima during the period of operation of the Corps Medical Battalion. This activity was the first field medical hospital to function on Iwo Jima, receiving its first cases on D day plus six. For the next 30 days a great many of the eye casualties filtered through this hospital along with neurosurgical casualties. Most of the casualties had had some form of first aid administered at the forward aid-stations and were then rapidly transported to the hospital before evacuation from the island.

In no way is this a statistical report on eye diseases, as our period of observation and treatment was very short, and operative procedures were followed in from 1 to 3 days by evacuation. It is, instead, a review of the eye cases which were brought under observation, the problems encountered and the way in which they were met.

Eighty-one patients with eye injuries and eye diseases were admitted. The diseases and injuries encountered and the procedures employed are enumerated on page 434.

Most casualties with eye injuries were seen here after only a short interval, but enough time had elapsed for the appearance of edema and ecchymosis of the eye and its adnexa, together with an outpouring of mucus and tears. Occasionally a mucopurulent discharge escaped when the palpebral fissure was forcibly opened. Foreign bodies and dirt were present in abundance. In addition to this clinical ocular picture, the skin over the face and neck often showed the results of an atmospheric blast concussion. These skin wounds oozed a serum or were covered with a blood coagulum. A dirt film covered the body everywhere.

Shock was combated, pain controlled, and tetanus toxoid routinely administered. The face was thoroughly cleansed with green soap and water after which a detergent was applied and the eyelashes and eyebrows were clipped and the face or scalp was shaved if necessary. Some patients who required extensive plastic repair of the eyelids or adjacent facial defects were treated under intra-

<i>Operative procedure</i>	<i>No. of cases</i>
Enucleation	5
Evisceration	14
Approximation of tissue about the eye, plastic.....	14
Wounds packed, open.....	6
Magnet application	9
 <i>Disease or injury</i>	 <i>No. of cases</i>
Perforation of sclera.....	5
Perforation of cornea with iris prolapse.....	8
Perforation of cornea without iris prolapse.....	4
Foreign bodies of the cornea and conjunctivae.....	25
Blast concussion, atmospheric.....	19
Perforation of conjunctivae and Tenon's capsule.....	1
Orbital proptosis, traumatic, hemorrhagic.....	2
Orbital foreign bodies.....	4
Dehiscence of orbital roof, traumatic.....	1
Hemorrhage, intra-ocular, traumatic.....	6
Commotio retinae	2
Detached retina, traumatic.....	1
Detached choroid, traumatic.....	1
Burns, face, cornea, lids, conjunctivae.....	3
Iritis	5
Conjunctivitis, chronic, staphylococcic.....	5
Conjunctivitis, acute, purulent.....	5
Solar retinosis	1
Multiple sclerosis (nystagmus, retrobulbar neuritis and paralysis of convergence center)	1
Optic neuritis, unilateral.....	1
Closure of central retinal artery.....	1

venous pentothal anesthesia; other procedures were carried out under local or topical anesthesia.

All jagged wounds were trimmed and debrided, conserving as much tissue as possible. Wounds of the lids and adjoining facial areas were thoroughly probed, irrigated with sterile normal saline solution, and dusted with finely powdered sulfanilamide. These wounds were closed by the approximation of tissues and by plastic flaps in most instances. The lid margins were often found drilled with holes having small bits of volcanic ash or human flesh in their depths. These had to be dug out or expressed by counterpressure. If no globe perforations were present the operation was concluded by instilling cocaine-homatropine into the lower conjunctival fornix, followed by application of sterile vaseline ointment and an extensive, firm compression bandage over vaseline gauze strips.

In the case of perforations of the globe, thorough eye toilet was undertaken. Corneal perforations near the limbus were plugged with a prolapsed iris, which already had adherent accumulations of mucus and dirt. The anterior chamber was re-formed and oc-

casionally foreign bodies could be seen within it or visualized in the vitreous body by ophthalmoscopy. Central corneal perforations were not accompanied by prolapse of the iris. Portions of the lens in the immediate vicinity of the track traveled by the foreign body were already opaque.

The first few cases of perforations of the globe with iris prolapse were treated by resection of the prolapsed portion of the iris, after chemical cautery of the wound, and the perforation was covered by a sliding flap. These patients were detained for 2 or 3 days to be certain that no ocular damage could result from further transportation. All patients received sulfadiazine, 1 gm. every 3 hours by mouth, and calcium penicillin solution, 30,000 Oxford units, every 3 hours intramuscularly during their hospitalization. These patients did well. First dressings were made after 12 hours, and second dressings 24 hours after the first.

On one occasion, shortly after our activation, at the first dressing of a conjunctival sliding flap case, it was noted that extensive infection was present under the flap, at the site of the perforation of the cornea. The infection spread into the cornea, producing a purulent keratitis and an anterior uveitis. The flap was immediately broken down, the sutures were removed, and the perforation was enlarged, whereupon aqueous humor escaped. The anterior chamber was irrigated with a freshly prepared solution of calcium penicillin, 10,000 units per cubic centimeter, much in the same manner as an irrigation done during an extracapsular cataract extraction to remove the lens cortex. Subconjunctival injections amounting to 2 cc. were made over the globe, using the above dilution of the commercial preparation of calcium penicillin. By the following day the results of this heroic therapy were most gratifying. The anterior chamber and iris were clear, and it was evident that there was a remarkable regression of the infective process.

Von Sallmann and his coworkers (1) (2) recently reported their observations with purified derivatives of calcium and sodium penicillin which combated intra-ocular infections by injection into the aqueous and vitreous humors. They showed that small concentrated quantities of the salts of penicillin, when injected into the aqueous or vitreous humors within a 6-hour period after inoculation with pathogenic bacteria, were sufficient to prevent infection. No untoward chemical reaction was noted with single 0.2-cc. injections of the concentrated salts of penicillin.

Recently Struble and Bellows (3) have demonstrated the increased concentration of the drug within the eye after subconjunctival injection of the salts of penicillin. Seelig (4) has

reported successful treatment of gonorrheal ophthalmia by subconjunctival injection of the salts of penicillin.

In all cases of corneal perforation seen thereafter, the anterior chambers were routinely irrigated with a solution of calcium penicillin. This solution was injected into the vitreous body in amounts of 0.2 cc. in all cases with scleral perforations, and subconjunctival injections of 2 cc. of calcium penicillin solution were made in all cases of perforation of the globe. This was in addition to the established methods of treating these conditions.

The results were most reassuring. First dressings showed the chemically produced conjunctival edema to be in abeyance. The conjunctivae were white and clear, and the aqueous humor and the iris architecture were clear.

Blast injuries with associated embedding of volcanic ash foreign bodies in the eyelid, cornea, and conjunctiva were most commonly observed. These injuries resulted from nearby exploding hand grenades, land mines, artillery shells, and mortar shells which threw a terrific blast of air and volcanic ash onto the exposed portions of the body, often only onto the face and hands. Nineteen patients with bilateral eye injuries from concussion blast were treated. The corneal epithelium was often abraded or partially or completely denuded, with foreign bodies embedded in the deeper corneal layers. The fornix was filled with many small pieces of volcanic ash. The lids were often in spasm, swollen, with foreign bodies extruding through the palpebral fissure. Mucus or mucopurulent discharge in small amount was always present. The conjunctivae and lids showed edema and occasionally ecchymosis.

Recovery from this type of injury was rapid after removal of the foreign bodies and instillation of atropine and an anesthetic. Penicillin ointment, 10,000 units to 1 gram of anhydrous lanolin, was used in the lower conjunctival fornix, and a compression bandage was applied over strips of vaseline gauze.

Of the 19 patients with eye injuries caused by atmospheric concussion blast only 2 demonstrated the principle of a contrecoup injury, commotio retinae. In one case the retinal edema was limited to the macula, and in the other case the edema spread from the macula, nasally, to the underside of the disk. In both instances the fovea was seen as a cherry-red spot within the fluffy grayish-white macular edema.

One of the patients hospitalized because of corneal foreign bodies and associated iritis was discovered to have bilateral solar retinosis of long standing. The right eye showed the uncorrected visual acuity to be reduced to 20/65 and Jaeger's test type No. 3. This reduced vision was due entirely to fundus pathosis. A posi-

tive central scotoma of small size was present. In the left eye there was no visual disturbance other than metamorphopsia. In the fundus could be seen a wrinkling and irregularity of the retina at the fovea, with probable glial proliferation. The fundus of the right eye showed a definite small hole at the fovea surrounded by glial proliferation.

When the lids, conjunctival structure, and the globe were shattered by some tearing, explosive pieces of shell, it was the immediate concern to save as much of the tissue as possible to give maximum future cosmetic results. Often the globe was collapsed, with the loss of intra-ocular structures. In such cases the torn portions of the sclera were retained and folded upon themselves, the conjunctivae being closed over this stump, and only the uveal tract being removed in its entirety. Finely powdered sulfanilamide was used in abundance in all these extensive wounds. Torn lids were so sutured together as to give least distortion and maximum cosmetic effect. All wounds communicating with the sinuses were partially closed, with drains inserted if contamination was extensive. Firm compression bandages did much to reduce edema, hold waltzed flaps in place, and control oozing or capillary hemorrhage. No attempt was made to treat fractures of the orbital bones by mechanical fixation. Bone spicules were removed when loose and not in approximation.

To aid in localizing intra-ocular magnetic foreign bodies silver wire clips were inserted into the conjunctiva 1 mm. from the limbus at the 12 and 3 o'clock positions. A portable electromagnet was applied to nine eyes showing x-ray evidence of intra-ocular foreign bodies, but only two of these eyes contained magnetizable foreign bodies. Both lay in the vitreous body, were of small size, and were brought forward over the ciliary body and removed through a corneal incision at the limbus. The majority of the foreign bodies were non-magnetizable, black, porous volcanic ash. No instrument was available to remove these from the vitreous body under direct observation. Surprisingly, minute particles embedded in the iris caused little reaction, and when multiple were either left alone or, if a corneal wound existed, the anterior chamber was irrigated with calcium penicillin solution, which often washed them free.

Only one case of retinal detachment and one of choroidal detachment were seen, both of traumatic origin. In the patient with the retinal detachment, the detachment was opposite a scleral perforation in the upper inner portion of the globe. No radiopaque foreign body was seen. No foreign body was seen by ophthalmoscopy. Two retinal holes were identified in the bulbous de-

tachment. During convalescence a vitreous hemorrhage occurred, obscuring all view of the fundus.

The patient with the choroidal detachment showed on admission only a bulbar, brawny edema and an atmospheric blast concussion abrasion of the corneal epithelium. There were no foreign bodies or perforations in the globe. The pupil dilated poorly when atropinized, a mild anterior uveitis appeared overnight, and posterior to the ciliary body on the nasal side a dark circumscribed choroidal detachment appeared. The opposite eye was normal, and the patient had no other injuries.

Three ocular burns were seen, each due to a different agent. The phosphorus burns were most interesting, though involvement of the eyes was rare. The eyes showed small specks of brown to yellowish-white foreign bodies embedded in the cornea and conjunctiva. The lids showed dirty brown to black smoking areas which had a distinctive burnt-phosphorus odor. The corneal and conjunctival particles were successfully touched with 2-percent copper sulfate solution, those of the skin with a 5-percent solution, whereupon the color of these areas changed to a blackish-green. The corneal and conjunctival epithelium in the immediate region of this solution became cloudy and edematous.

The foreign bodies were then removed with the point of a hypodermic needle and the eye was thoroughly irrigated with sterile normal saline solution. Atropine sulfate, 1-percent solution, and sterile vaseline were then applied to the conjunctival fornix. Vaseline gauze strips were applied to the lids and adjacent damaged skin areas and covered with gauze pads, all held tightly in place by a firm compression bandage.

First dressings made 24 hours later revealed a remarkable reduction of edema, and clean epithelized areas where the skin had been burned. The corneal epithelium had regenerated and was everywhere clear, even where Bowman's membrane had been injured. Conjunctival chemosis rapidly disappeared. The burns were superficial; no untoward sequelae were seen. A patient with a picric-acid burn disclosed only a superficial, yellow burn of the face and lids with edema, and abrasion of the corneal epithelium. This healed readily with the usual treatment for this type of burn. Molten lead caused a third burn of the lids, abrasion of the corneal epithelium and chemosis of the conjunctiva. This also healed without sequelae, being a superficial burn.

Orbital foreign bodies exciting no inflammatory reaction were not removed. In two instances it was deemed advisable to turn down a flap at the eyebrow, dissect the periorbital from the roof

of the orbit and incise this meridionally to remove the foreign body from within the orbit.

Orbital hemorrhage was so great in two instances that the eyeball was proptosed and the palpebral fissure was obliterated by firm, swollen lids, causing great pain. Lateral canthotomies were performed in each case, resulting in relief from pain and pressure.

All patients with iritis responded readily to local instillations of atropine sulfate solution and the intramuscular injection of calcium penicillin solution, 30,000 units in 10 cc. of distilled water, every 3 hours. Most of these patients were returned to duty without evacuation.

Staphylococcic conjunctivitis, with or without blepharitis or keratitis, was seen in a few patients, but in each instance there was a history of recurrence, exacerbation and previous treatment. It is of interest that none of these patients had been desensitized with staphylococcus toxoid.

Cleansing the lids with 1-percent silver nitrate, and application of calcium penicillin ointment in the fornix and on the lids proved the most successful method of treatment. From smears and cultures autogenous vaccines were prepared which were valuable in the treatment of these patients. Those cases coming under observation here were due to a coagulase-positive staphylococcus showing moderate hemolysis. In one instance the organism was penicillin-fast, but yielded to sodium sulfadiazine ointment applied locally. One patient showed an allergy to the local application of penicillin.

There were no patients who had riboflavin deficiencies with associated ocular signs in the Iwo Jima campaign. No patient was seen from any of the organizations with circumlimbal injections, marginal corneal vascularization, or limbal ulcers which could be considered primarily due to an ocular riboflavin deficiency. During the Saipan and Tinian campaign there was a high incidence of such ocular manifestations. The medication available on Saipan was a capsule containing multiple vitamins assayed to contain 0.5 milligrams of riboflavin. These patients responded, fortunately, to large doses of these multiple vitamins by mouth. For the Iwo Jima campaign large quantities of the intravenous, concentrated riboflavin preparations were available, but at no time was this therapy required in an eye condition.

In seeking the cause of this discrepancy it was noted that on Saipan 50 percent of the casualties were medical, with dengue and diarrheas, whereas on Iwo Jima almost no such medical cases were seen. Another explanation may be that the climate and seasons of the year were different in each instance. On Saipan it was mid-

summer, all men were hot and all perspired freely; on Iwo Jima perspiration rarely occurred from climatic causes. On Iwo Jima there was an abundance of food and greater variety of diet, fortified with essential vitamins. Weight losses were common on Saipan, but not so during the Iwo Jima campaign.

It is unusual to find medical ophthalmologic problems at the front. The following brief résumés are therefore presented.

Case report.—A 19-year-old machine gunner was evacuated from the front lines because he couldn't see. Inquiry disclosed that the patient had experienced previous attacks of partial loss of vision, first noted at New River in 1942. On one occasion he was hospitalized because of "paralysis" of both hands and of the stomach, but experienced no visual disturbance. During the Saipan campaign the patient experienced headaches and photophobia and other vague visual complaints. On the way to the Iwo Jima operation, at the recreation area, the patient's right eye and upper lip "failed" him. Vision was blurred; the condition lasted 2 weeks and then disappeared.

Four days preceding his arrival at this activity his vision blurred in both eyes, diplopia was recognized, and he became dizzy, but no paralysis or paresthesia was noted.

Examination disclosed the visual acuity of the right eye to be 20/200, of the left eye 20/30; the left was the fixing eye. There was a paralysis of convergence, which produced a moderate degree of divergence of the visual axes. The ocular fundi were negative. The pupils reacted normally, but a very pronounced rotary nystagmus was visible. Gross central field examination revealed a large central scotoma with normal blind spots on the right, and this eye was painful to movement. The left central field and blind spot were normal. This was considered to be a case of retrobulbar neuritis of the right eye. In addition to these eye findings the abdominal reflexes were absent and there was paresis of the right side of the face, peripheral in type, involving the forehead, eyelids, lips, and cheek. The diagnosis was multiple sclerosis.

Since returning to the rehabilitation area some interesting cases, the aftermath of the campaign, have been seen. One was an occlusion of the central retinal artery, producing sudden and lasting blindness of the involved eye. The history again suggested that there had been a small-branch occlusion of the same eye on Iwo Jima; the main branch occluded shortly after arrival in the rear area. No history of trauma was obtained. Another patient experienced gradual onset of blurred vision and pain in the right eye but was otherwise in good physical condition. Examination disclosed unilateral optic neuritis, with field changes showing enlargement of the blind spot and a central scotoma. Quadrantal peripheral field defects were present in both right and left peripheral fields. Again there was no history of trauma.

In conclusion it is believed that adequate definitive treatment of eye cases in the field is preferable to first-aid treatment prior to reaching a rear base. In many instances early approximation and closure of defects of lids and adjacent skin areas gave a better

plastic result with less scarring. Evisceration gives the better stump for a prosthesis. Heroic parenteral use of calcium penicillin will suppress many an ocular infection with no apparent early untoward chemical reactions.

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GREEN PEA JUICE GIVES PENICILLIN

Aqueous extracts of ground dried peas form a good medium for the production of penicillin. There are, however, certain disadvantages in the use of such material on a large scale, although it forms a very convenient basis for a scheme of fractionation of the active constituents concerned. A press juice made from entire green peas (seeds and pods) forms an excellent medium for penicillin production.—COOK, R. P., and TULLOCH, W. J.: Green pea juice as medium for production of penicillin. *Nature* 155: 515, April 28, 1945.



HISTAMINE FOR MIGRAINE

Thirty-four patients with severe migraine were treated with the intravenous injection of 1 mg. of histamine as 2.75 mg. of histamine acid phosphate. This is diluted in 500 cc. of isotonic solution of sodium chloride and injected very slowly, the speed of injection usually starting at about 5 drops per minute, the rate being increased as rapidly as is tolerated by the patient. Seven were improved and 24 became symptom free. Intravenous histamine should not be given to patients with peptic ulcer or vascular disease and may be dangerous if indiscriminately used.—BUTLER, S., and THOMAS, W. A.: Intravenous histamine in treatment of migraine. *J.A.M.A.* 128: 173-175, May 19, 1945.

ANESTHETIC AGENTS IN THE TREATMENT OF BATTLE CASUALTIES

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The chances of survival of the wounded man are greater today than ever before in the history of man and war. Evacuation by air, the sulfonamides, and plasma, have been mentioned as the factors most largely responsible for this improvement. The newer anesthetic agents and the modern technic of anesthesia have not received the credit to which they are entitled, not only in facilitating the treatment of the wounded man but also in making that treatment nearly painless. Unquestionably the splendid anesthesia which has been made readily available by the newer anesthetic drugs, and the refined technics of administration, have been factors in decreasing the mortality of the wounded.

In the handling of large numbers of fresh battle casualties by limited medical personnel, time is at a premium and must be conserved. In a little more than a year, 3,151 wounded soldiers, sailors and marines were treated on board a hospital ship by 16 medical and 2 dental officers in the course of 6 island campaigns. Many of the casualties came directly from the beach a short time after receiving their wounds, while others came from other ships and field hospitals. The hospital ship was usually filled to capacity within 36 hours. Definitive treatment was carried out at the earliest possible moment and the patients were under observation and treatment during the voyage to a base hospital.

The many types of anesthesia available, and the ease of administration, made it unnecessary to subject to additional pain and to an unpleasant experience men who had already escaped death on the battlefield and aboard ship. Although many wounds could be properly cleansed and dressed without anesthesia, 627 operative procedures were performed under anesthesia. The patients concerned in this report, although young and previously healthy and robust, presented all types of lesions when they were admitted to this hospital ship and some were in various stages of shock and exsanguination.

The choice of anesthesia is important, just as it is in civilian practice, and the indications and contraindications for each anesthetic agent must be known. The injudicious use of an anesthetic

agent, with consequent poor results, inevitably leads to a tendency to discredit the anesthetic. There was no physician anesthetist on the medical staff of this hospital ship, but several medical officers were interested in and had had experience in anesthesia. A well-trained nurse anesthetist was available to give inhalation anesthetics.

In civilian practice and in scheduled operations in military hospitals nearly all patients are given preoperative medication. In the treatment of fresh battle casualties this is not often possible because the patients wait in a queue outside the operating room and the time at which they will be taken to the operating table is not known. Some patients, however, had been given morphine as a first-aid measure on the beach. Lack of preoperative medication was not observed to be a serious disadvantage. It is possible that the mental attitude had something to do with this, for whereas a well patient looks forward to an elective operation with displeasure and sometimes fear, the wounded man anticipates the surgical procedure as the relief of his misery and pain and as the beginning of his road to recovery.

PENTOTHAL SODIUM

At a base hospital in Egypt, pentothal, either alone or in combination, was used in 85 percent of the surgical cases. It was found to be the most satisfactory anesthetic agent and there were no ill effects. In the treatment of the casualties from the Dieppe raid, pentothal was used alone in 51 percent of the cases, and in another report from a combat zone pentothal was used in 153 (30.3 percent) of 504 cases.

That pentothal is widely used and that its popularity is increasing are obvious from the reports that have appeared. It is somewhat disconcerting and alarming to learn that an analysis of 7,500 case samples of anesthesia revealed that the death rate attributable to pentothal was six times higher than that of all other anesthetic agents combined. It is well known that pentothal decreases the sensitivity of the respiratory center. It should always be administered with the greatest caution and with a full understanding of its inherent dangers. The respirations and the color of the patient should be carefully observed and the solution injected very slowly, in small quantities, as necessary. Pentothal, skillfully administered, is a safe and satisfactory anesthetic agent.

Pentothal sodium was used as the anesthetic of choice in 404 (65 percent) of 627 operative procedures carried out on this hospital ship. In some additional cases it was used to supplement other forms of anesthesia and to carry out special departmental procedures. Debridements, removal of foreign bodies, and dress-

ings constituted 224 of these cases. These procedures were frequently extensive and time consuming. There were 96 cases in which fractures were reduced and casts applied, the majority of which were fractures of the femur necessitating reduction on the fracture table and the application of a double hip spica cast. In 45 major operations, including 2 disarticulations of the hip and 1 disarticulation of the shoulder, pentothal was the sole anesthetic agent and it has become the anesthetic preferred in amputations. Ten craniotomies, 2 laparotomies, and 2 laminectomies were also accomplished under pentothal anesthesia.

One advantage of pentothal anesthesia is that little equipment is necessary; it can be used where it would not be possible to take elaborate apparatus. Medical officers, dental officers, nurses, and corpsmen have given these anesthetics. The use of pentothal has greatly reduced the time necessary to treat each patient and usually the patient can be anesthetized while the surgeon is making the necessary preparations for surgery. Patients with multiple and extensive wounds require a general anesthetic; pentothal suffices. Many of these patients have bled profusely and some are in mild shock; in such cases pentothal is the most satisfactory anesthetic agent and plasma and blood can be administered through the same needle as the pentothal. Many patients must be anesthetized several times during the course of treatment. The ease of administration and the absence of unpleasant after-effects make pentothal the ideal anesthetic in these cases.

Pentothal was always used in 2½-percent solution. When patients were being admitted sporadically, the solution was made as needed by dissolving 1 ampule (0.5 gm.) in 20 cc. of sterile triple-distilled water. When a great number of patients was anticipated the solution was made in large quantities, use being made of autoclaved plasma bottles, and it was withdrawn into syringes as needed.

A No. 18-gage needle was found most satisfactory. Venipuncture is more easily accomplished with the larger needle and there is less tendency for the lumen to become occluded. Usually 5 cc. of the solution was injected slowly while the patient counted. If after a reasonable interval unconsciousness was not produced, another cubic centimeter was injected. Thereafter the drug was injected only in very small quantities (0.2 to 0.4 cc.), at infrequent intervals, and only when the patient stirred or when there was other evidence that the degree of anesthesia was too light. All anesthetists were cautioned as to the inherent dangers of the anesthetic and were encouraged to give as little of the solution as was consistent with a satisfactory level of anesthesia. It is

felt that this method of administration and these precautions prevented complications.

TABLE 1.—*Anesthetics used in performance of 627 surgical procedures*

Procedure	Intra-venous pento-thal sodium	Spinal	Local	Local and pento-thal	Nitrous oxide-oxygen-ether	Ether	Avertin and local	Total
Debridement, removal foreign body, dressings.	224	11	40	.....	3	1	.....	279
Reduction of fractures, application of casts.	96	41	3	.....	.....	.....	.....	140
Major amputations.	45	13	.....	.....	2	1	.....	61
Laparotomies.	2	10	4	.....	43	3	.....	62
Craniotomies.	10	.....	12	8	.....	.....	2	32
Miscellaneous.	27	3	15	3	5	.....	.....	53
Total.	404	78	74	11	53	5	2	627

SPINAL ANESTHESIA

Two absolute contraindications to the use of spinal anesthesia, i.e., shock and anemia, are frequently present in battle casualties. Because it is not always possible to obtain blood counts and estimation of hemoglobin, unsuspected anemia may be present. The fact that wounds may be widely distributed also limits the usefulness of spinal anesthesia in the treatment of battle casualties.

The dangers of spinal anesthesia are not universally appreciated, although unfortunate sequelae in both civilian and military practice have been publicized. It should be taught and it should be recognized by all who make use of this form of anesthesia that it should not be administered without careful consideration, that it is not a minor procedure without risk, that it should be given by or under the supervision of those who have had experience in its use, that there are definite contraindications to its use, and that it should not be employed for small procedures in cases where anesthetics fraught with less danger will suffice.

In at least two instances on this ship, patients went into profound shock and had serious respiratory embarrassment following the administration of spinal anesthetics. Vigorous and energetic treatment was necessary to prevent a fatal outcome in each case. In retrospect, contraindications to the employment of a spinal anesthetic were obvious, but had been overlooked in the rush of caring for a large group of casualties.

Spinal anesthetics were used in 78 (12.2 percent) of 627 procedures in which anesthesia was required. In nearly all cases it consisted of crystals of procaine hydrochloride, never in excess of 150 mg., dissolved in aspirated spinal fluid. Forty-one patients required reduction of fractures of the lower extremities and application of casts, while amputations were performed in 13

instances. In the latter part of the period covered by this survey, pentothal practically displaced spinal anesthesia for these procedures. In the last group of 122 operative procedures requiring anesthesia, spinal was used only once for the reduction of fracture, and was not used in any amputations.

Notwithstanding this waning popularity on this ship, the spinal route is a splendid method of anesthesia and is superb in selected cases. In injuries involving the lower abdomen, in the absence of shock, and when hemorrhage has not been great, this is the anesthetic of choice. Spinal anesthesia requires only a small amount of special equipment and it can be administered by the surgeon when an anesthetist is not available, the patient's blood pressure, pulse and respirations being reported by a nurse or hospital corpsman.

INHALATION ANESTHESIA

The superior safety of ether as an anesthetic agent seems never to have been questioned. When the anesthetic gases are not available, ether alone is the anesthetic of choice in some abdominal, thoracic and abdomino-thoracic injuries. It has a very great advantage in that it can be safely and satisfactorily administered in the absence of a trained anesthetist and the anesthesia can be maintained over a long period of time. Ether was used as the sole anesthetic agent in only 5 cases (0.8 percent) in this group of 627 procedures.

Muir said that in the desert, where the heat is excessive, ether boils and chloroform became a necessary anesthetic at his station. In the tropics a satisfactory level of anesthesia is also difficult to maintain because ether evaporates so rapidly. Induction of ether anesthesia is always slow. On the hospital ship it would have been impossible to complete the work if ether anesthesia had been employed in all major surgery.

A gas machine was part of the equipment of the hospital ship and a nurse trained in anesthesia was a member of the staff. Nitrous oxide-oxygen-ether anesthesia was employed in 53 (8.45 percent) procedures. Forty-three of these operations were laparotomies, some of which were associated with thoracic injuries. One of the miscellaneous procedures in which the nitrous oxide-oxygen-ether combination was used was the repair of a lacerated diaphragm using the thoracic approach.

In surgery of battle casualties the greatest field of usefulness of gas-oxygen-ether anesthesia is in the treatment of abdominal, thoracic and abdomino-thoracic injuries. The positive pressure made available by the use of the gas machine is frequently of great advantage in these cases.

LOCAL ANESTHESIA

The local infiltration of procaine to produce anesthesia of a well defined field is so well understood as hardly to deserve comment. That special skill is necessary to inject the solution properly in order to obtain satisfactory anesthesia is undeniable. On this ship, surgery of wounds of the scalp and skull, thoracotomies and the removal of superficial metallic foreign bodies have comprised the majority of procedures for which local anesthesia was used.

Local anesthesia was not considered desirable for the cleansing and debridement of large wounds. It is not feasible to inject the solution locally before cleaning the part, and thorough cleaning by washing with soap and water and irrigating with physiologic saline solution, the method found most satisfactory, can hardly be done without anesthesia. The patients are occasionally apprehensive and have a low threshold for pain. Other forms of anesthesia were considered more desirable.

Excluding its use in isolated departments and wards, local infiltration anesthesia was employed in 74 (11.8 percent) of this group of 627 procedures.

SUMMARY

1. Anesthesia has had a role in decreasing the mortality of battle casualties.

2. On a hospital ship 3,151 wounded soldiers, sailors, and marines were treated during the course of 6 island campaigns. There were 627 procedures which required anesthesia.

3. Intravenous pentothal sodium was employed as the anesthetic agent in 65 percent of the cases. It has become the anesthetic of choice in amputations and in the reduction and fixation of fractures of the long bones. The many advantages of pentothal have made it the most valuable single anesthetic agent in the armamentarium of the medical staff on a hospital ship. It has been found to be a safe anesthetic when properly administered.

4. Spinal anesthesia was used in 78 cases (12.2 percent). Shock and anemia, frequently found in the wounded, contraindicate its use. For some lesions below the umbilicus, especially wounds of the lower abdomen, in the absence of contraindications, it is the anesthetic of choice.

5. Ether was the sole anesthetic agent in 5 cases (0.8 percent), while the nitrous oxide-oxygen-ether combination was employed in 53 (8.45 percent) procedures. Inhalation agents were most useful in surgery of abdominal, thoracic and abdomino-thoracic injuries.

6. Local infiltration anesthesia was not considered suitable in the management of the large wounds. It was useful in the treatment of head wounds, in the removal of superficial metallic foreign bodies, and in performing thoracotomies.

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HEMOGLOBIN IN PLANTS

Hemoglobin, the red pigment characteristic of vertebrate blood, consisting of a protein, globin, combined with the iron-containing porphyrin derivative, hematin, occurs sporadically among the invertebrates, sometimes in unexpected parts of their bodies.

A new chapter has now been added to this story by the discovery that a red pigment of hemoglobin type can be recovered from the root nodules of leguminous plants. It forms with oxygen a loose compound in which the iron remains in the divalent state and which reacts like hemoglobin with carbon monoxide and ferricyanide. The function of this compound is not yet known, but it is thought to be connected with nitrogen fixation by the nodules. Neither the plant cells alone nor the nitrogen-fixing bacteria alone can produce the compound; it is a true product of the symbiosis, and this suggests that only by some cell-bacterial interplay can the highly specific globin be produced in the plant kingdom, for it is the synthesis of this globin which limits the distribution of hemoglobin throughout nature.—ANNOTATIONS: Hemoglobin in plants. Lancet 1: 538, April 28, 1945.

PENTOTHAL SODIUM IN ORTHOPEDIC SURGERY

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There has been much discussion on the possibility of pentothal sodium (sodium ethyl thiobarbiturate) supplanting other anesthetic agents in various types of surgical procedures. It is now accepted as one of our common anesthetic agents. Since 1935 numerous reports in the literature established its place in the armamentarium of anesthesia, and it has been widely used in the present war.

The early conservative group of anesthesiologists recommended and restricted its use to minor surgery, in which the total amount of drug was small and the duration of the operation was relatively short. As the drug grew in popularity, another group recommended its use for all types of surgery. From our experience we do not fully agree that it is the best agent for all types of surgery; however its use in orthopedic surgery has been found very satisfactory.

The results of using this anesthetic in a series of 500 cases at the U. S. Naval Hospital, St. Albans, New York, over a 6-month period, are presented here. This series comprised all types of orthopedic cases in which pentothal sodium was employed.

Regardless of the type of anesthetic agent used, its administration is facilitated by some form of preoperative preparation and medication. With pentothal sodium, the preoperative preparation of the patient consists in the removal of all removable prostheses from the mouth and having the stomach, the bladder and the rectum empty. For patients in shock or with great debility and when the operation is to be extensive or prolonged, or both, some form of intravenous therapy is started.

In this series the following routine of preoperative medication was found the most satisfactory: Pentobarbital sodium, grains $1\frac{1}{2}$ orally the previous night, and again 1 hour before operation, and morphine sulfate, grain $\frac{1}{4}$, and atropine sulfate, grain $\frac{1}{150}$, subcutaneously not less than 45 minutes before operation. In cases of emergency surgery, when this preoperative routine could

not be followed, morphine sulfate, grain 1/6, and atropine sulfate, grain 1/200, were given intravenously from 3 to 5 minutes before administration of the general anesthetic. As morphine is a respiratory depressant, as is also pentothal sodium, it is essential that the morphine be given far enough in advance to avoid the cumulative respiratory depression of both drugs after the anesthesia is in progress. In cases of laryngospasm, an additional dose of atropine sulfate, grain 1/200, is given intravenously.

Intravenous anesthetic agents when first introduced were generally used in a 5-percent solution, but because of the ease with which an overdose might be given, and to decrease the possibility of venous thrombosis and to lessen the amount of tissue irritation by extravasation, the present trend is toward the weaker solutions, the most popular today being a 2½-percent solution. In this series a 3⅓-percent solution was found most effective. The slightly stronger solution was deemed necessary because of the number of young, robust patients.¹ This concentration was prepared by dissolving 1 gm. of pentothal sodium in 30 cc. of distilled water. In using this stronger solution we were able to give the larger doses needed in the same volume of 3⅓-percent solution for induction and maintenance as would be required of the 2½-percent solution in the older and more cachectic type of patient. It has been shown² that patients in shock, or with marked debility, need only a fraction of the usual dose of pentothal sodium to induce anesthesia. Failure to recognize these conditions may easily lead to an overdose.

Pentothal sodium was selected as the anesthetic of choice in orthopedic surgery for the following reasons: (1) Ease in administration; (2) rapid induction; (3) absence of an excitable second stage; (4) adequate relaxation; (5) readily controllable maintenance; (6) elimination of the time limit set by a single dose of a spinal anesthetic; and (7) lack of postoperative complications.

The ease of administration of this anesthetic is partly due to the simplicity of the equipment necessary. For anesthesia of short duration, the equipment used here consisted of a regulation 20-cc. syringe with an 18-gage needle. For operative procedures of longer duration, the same type of syringe was employed, but the 18-gage needle was attached to a 24-inch piece of rubber

¹ LUNDY, J. S.; ADAMS, R. C.; and SELDON, T. H.: Intravenous administration of anesthetic agent; comparison of technic for robust patients and for patients in shock, U. S. Nav. M. Bull. 42: 11-16, January 1944.

² ADAMS, R. C., and GRAY, H. K.: Intravenous anesthesia with pentothal sodium in case of gunshot wound associated with accompanying severe traumatic shock and loss of blood. *Anesthesiology* 4: 70-73, January 1943.

tubing by either a Luer-Lok connector or a glass adapter. A one-way stop-cock was inserted between the syringe and rubber tubing. This arrangement leaves the anesthetist free for emergencies.

After an initial injection of approximately 1 cc. as a test dose for sensitivity, and after a brief wait, a rapid injection of from 7 to 12 cc. of 3 $\frac{1}{3}$ -percent solution is given to induce complete anesthesia in from 3 to 5 minutes.

During induction the excitable stage is almost completely absent. It is unnecessary to apply any restraints. There is an absence of that apprehension which is often produced when a face-mask is applied.

After the initial induction and leveling off of the anesthesia, it is a simple matter to maintain the desired depth by additional injections of 3 $\frac{1}{3}$ -percent pentothal sodium at regular intervals. This is especially true in orthopedic surgery, inasmuch as the relaxation desired is relatively negligible. After the desired depth of anesthesia is reached, all preliminary procedures may be performed immediately. These may include the application of a tourniquet, preparation of a painful field, preoperative manipulations of joints, placing the patient in a desired position on the operating or fracture table, and any other procedure that is necessary before the major work is undertaken.

Shortly after the introduction of pentothal sodium in orthopedic surgery at this hospital there were numerous requests by patients for this type of anesthetic. They gave as their principal reasons the ease with which they went to sleep and the lack of postoperative discomfort. The number of operations performed under spinal anesthesia, which is the most commonly used in military practice, have been reduced and thereby the numerous postoperative complaints of backache and headache have been eliminated.

In a number of instances pentothal sodium was almost placed in disrepute, as in reports following the Pearl Harbor disaster. Such experience has taught that it should be used only by those trained in its proper administration. In capable hands, this type of anesthesia ranks with the best available. One must, however, take into consideration a proper evaluation of the patient as well as any contraindications that may be present.

Orthopedic procedures in which pentothal sodium was used

Arthrotomies	120
Manipulations and closed reduction.....	114
Open reductions	87

Amputations and revisions.....	45
Arthrodesis	5
Recurrent dislocations of shoulder (Nicola and Henderson operations)	27
Removal of bone plates and screws and bolts.....	21
Removal of head of radius.....	7
Incision and drainage, dressings and casts.....	37
Curettage, sequestrectomies, and removal of foreign bodies..	17
Spinal fusions	3
Vitallium cup arthroplasties.....	2
Insertion of bolts.....	3
Stader splints	4
Bone cyst of tibia.....	1
Patellectomies	7

The above list includes arthrotomies performed upon various joints, the majority being for internal derangement of the knee. Manipulations and closed reductions were frequently done for joints which required mobilization and also to evaluate the honesty of a patient's statements and complaints. Closed reductions were attempted in many cases before open reductions were performed. Open reductions consisted of the insertion of metal plates, screw fixations, introduction of medullary wires and the various types of bone-grafting procedures.

Some of the patients required multiple operations, such as the application of a Stader splint on one femur and closed reduction of a fractured femur on the opposite side, both being cared for at one time.

Bone-grafting operations on the femur require considerable time for preparation as well as the actual procedure itself.

In this series of orthopedic cases the amount of anesthetic used varied from 10 cc. of a 3 $\frac{1}{3}$ -percent solution (330 mg.) to 120 cc. of a 3 $\frac{1}{3}$ -percent solution (4,000 mg.), the majority of patients receiving on the average between 1,500 and 2,000 milligrams. The time for various procedures ranged from 5 minutes to 4 hours. Although oxygen and nitrous oxide-oxygen (50-50) were always available, the greater number of patients were given pentothal sodium without supplementary anesthesia.

The supplementary use of oxygen alone and the combination of oxygen and nitrous-oxide (50-50) was restricted to patients requiring 2,000 mg. and upward of pentothal sodium, and to surgical procedures lasting an hour or longer. In those cases it was used as a safety factor, as well as to decrease the total amount of pentothal needed. Likewise it was found that a smaller dose of pento-

thal was required to maintain good anesthesia in each succeeding hour of operation. After the first hour, the supplementary use of nitrous oxide-oxygen (50-50) reduced by from 25 to 50 percent the total quantity of pentothal necessary to maintain the same depth of anesthesia.

Difficulties encountered during the administration of pentothal in this series of cases were comparatively few. They were:

1. In two instances, the needle was introduced in anomalous arteries. The patients immediately complained of severe pain in the arm and hand after an injection of only 1 cc. of pentothal. The needle was removed and a venipuncture was performed at a different site, the anesthetic being continued without any further pain or discomfort.

2. Three instances of limited laryngospasm were encountered which ceased with the resumption of normal respiration after a short interval.

3. There were several cases of overdosage as a result of attempting to speed the induction. They were characterized by abnormally long periods of apnea. These were readily remedied by the administration of oxygen and the discontinuance of pentothal until respirations were resumed.

Postoperative complications following the use of pentothal sodium were considerably reduced as compared to those resulting from the use of other anesthetic agents. In this series of 500 patients, 10 percent complained of slight headache which disappeared within from 24 to 36 hours; 11 percent were nauseated; 7 percent of the latter vomited; 11½ percent showed signs of restlessness in varied degrees during the recovery period. Restlessness was severe enough in only 3 percent to warrant special care to prevent personal injury. These figures are not to be construed as the percentages of complications in this series, since frequently a single patient showed several of these reactions. There was only one case in which shock developed during the operation, and this was easily overcome by supportive measures. There were no cases of phlebitis, and no deaths.

These complications do not diminish the desirability of the use of this drug as an anesthetic agent. The same or even a greater percentage of complications may result from the use of any other anesthetic agent.

The number of contraindications has greatly decreased as the technic of administration has been developed. In this series of cases, because of the types of operations and the generally good physical condition of the patients, no contraindications to the use of sodium pentothal were found.

TREATMENT OF BEDSORES BY TOTAL EXCISION WITH PLASTIC CLOSURE

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In seven patients with transecting injuries to the spinal cord who had been evacuated from overseas for treatment of late complications, bedsores were a serious problem. As a general rule the decubitus lesions were undermined and heavily infected, and the granulations were avascular and unhealthy in appearance. The tendency to remain unhealed was due largely to associated malnutrition, with its accompanying anemia, reduced plasma protein, and avitaminosis. As these factors have been corrected by better feeding, administration of iron, blood transfusions, and vitamin concentrates, a healthy color has usually returned to the granulations and the sloughing of skin edges has ceased. It has been our experience, however, that discouragingly long periods are necessary for the lesion to fill in by granulation and that a covering of Thiersch grafts tends to break down when the patient is again permitted to lie on his back or get up in a wheelchair. In only two of these unfortunate injuries has the problem been settled by natural means; by spontaneous healing in one, and by death from intercurrent toxic hepatitis in the other.

Once the fundamental state of malnutrition has been corrected, the most effective solution to this problem is excision of the granulating area and plastic closure by sliding in flaps of normal subcutaneous tissue and skin under the antibacterial protection of penicillin. The possibilities of this procedure were demonstrated in Cushing General Hospital by Major W. B. Scoville. A recent article by Lamon and Alexander,¹ claims to record the first successful closure of such a decubitus ulcer by these means in a patient of the McCaw General Hospital's neurosurgical section, which was then under Major Scoville's charge. In this report no

¹ LAMON, J. D., JR., and ALEXANDER, E., JR.: Secondary closure of decubitus ulcers with aid of penicillin. J.A.M.A. 127: 396, February 17, 1945.

mention is made of the need for preliminary correction of secondary anemia, hypoproteinemia, and avitaminosis.

Total excision and plastic closure of these troublesome decubitus lesions, under the protection of penicillin, was done successfully in five Navy and Marine Corps patients. In each instance sufficient time had been given to correcting the systemic deficiencies, thereby obtaining a preliminary return of active growth of granulation tissue, elimination of sloughs, and coverage of bare areas of bone. With this preliminary treatment the degree of local infection was reduced, although the ulcers remained heavily contaminated.

Intramuscular injections of penicillin, 120,000 Oxford units daily (15,000 units every 3 hours), were started 24 hours before operation and continued until healing was progressing well, usually over a period of 2 or 3 weeks.

The area excised includes the skin edges and the walls of the ulcer out to normal subcutaneous fat. At the base an attempt is made to remove only the contaminated upper layers of granulation tissue, and whenever possible not to expose the periosteum and ligamentous tissue over the sacrum. To close the wound made by excising a large sacral decubitus ulcer it is necessary to undermine wide flaps out into each gluteal region, and transverse incisions must be made in order to slide in lateral flaps. In smaller (5 cm.) lesions, the entire area may be excised with an elliptical transverse incision which follows the natural cleavage lines of the skin and keeps the incision as far away from the contaminated anal area as possible. In cases of transverse myelitis, an anesthetic is usually unnecessary.

Certain other minor technical points have been found to be of value. No nonabsorbable suture material should be buried, and only a minimum of fine catgut. Electrocoagulation is the method of choice for dealing with small bleeding vessels. Wide retention sutures of fine stainless steel tied over large buttons (small buttons tend to cut through the skin after a few days) and No. 7 neurosurgical silk for the skin edges constitute the best type of suture material. Approximately every third cutaneous stitch should be placed as a vertical mattress suture, and should include a deep area of subcutaneous tissue to ensure wide approximation of the edges of the flaps with a minimal dead space. These must be tied without undue tension. No drainage is used. The incision is then covered with a 1-inch thick pad of sterile gauze and cotton waste, and taped transversely with adhesive to draw the buttocks together, thereby reducing lateral tension.

During the first week of convalescence the patient must remain

off his back and mostly in a prone position. If he does not have an indwelling urethral or suprapubic catheter, and is not able to control all leakage of urine, a Foley type catheter should be inserted in the bladder to keep the bed dry. Fecal contamination is prevented by a liquid and very low-residue constipating diet with sufficient paregoric to prevent any movement of the bowels over this period. Unless special circumstances arise, the first dressing is not done until the seventh day, when about one-half the sutures are removed, the remainder being left for another 10 days or longer.

In two cases in this series in which the area removed was approximately 5 cm. in diameter, the plastic incisions healed by first intention. In another case complicated by a small hematoma, there was limited separation of the flaps which later closed spontaneously. In the two other much more extensive plastic closures, there were separations of the central suture line, some 2 by 3 cm. in extent, which necessitated secondary plastic procedures. These resulted in complete healing and gave excellent end-results.

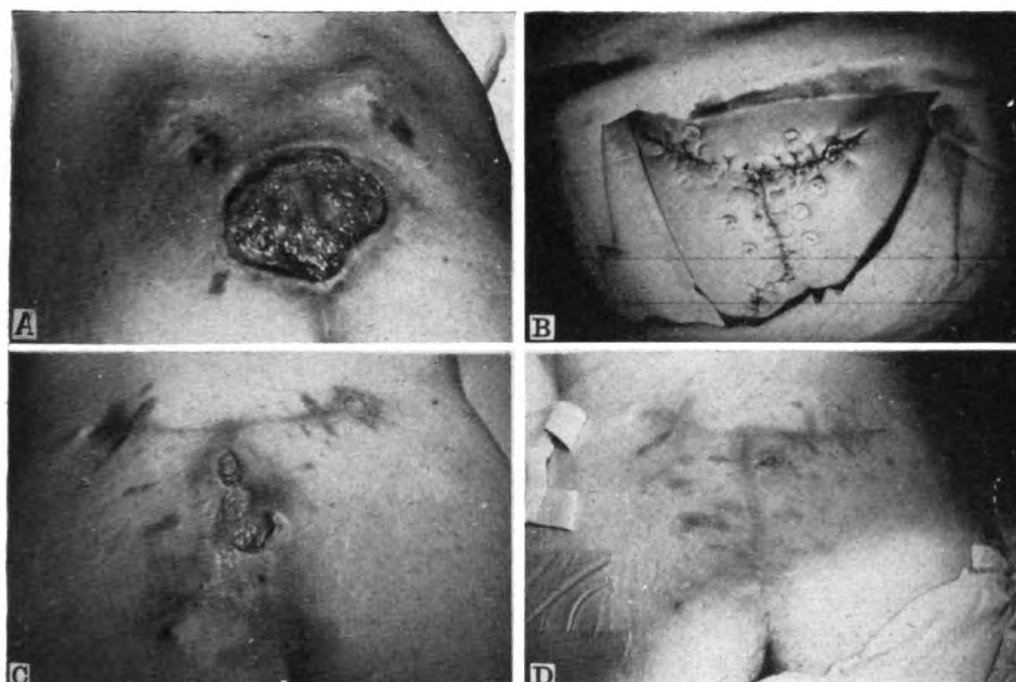
Even after the pressure area over the sacrum has been covered with full-thickness skin and subcutaneous fatty tissue, it can break down again under unfavorable circumstances which may arise in patients with transverse lesions of the spinal cord. This is illustrated in cases 1 and 2, in which late secondary ulcers appeared when the patients were forced to return to bed and lie on their backs because of late urinary complications. These minor ulcers, however, healed without difficulty shortly after the patients were able to get off their backs. Following a successful plastic closure, the same precautions must be observed as in any patient with insensitive skin over the sacrum.

Special points of interest and a number of related problems are illustrated by the following case reports:

CASE REPORTS

Case 1.—A yeoman, first class, age 24 years, was struck by a moving train on a blacked-out station platform in England. Among a number of other less serious injuries he suffered a transverse myelitis with flaccid paralysis of the legs and complete loss of sensation up to the twelfth thoracic segment. The lamina of the eleventh thoracic vertebra was fractured, causing complete block of the cerebrospinal fluid. A laminectomy was therefore performed, with removal of the indriven bony lamina and exploration of the spinal cord. The surgeon reported an extensive hematomyelia of the conus medullaris. The patient subsequently developed gross edema of his dependent parts, bed-sores, and urinary infection. For this reason a suprapubic cystostomy was done a month later.

On arrival in a Naval hospital in this country, 6 weeks after his injury, he was bedridden and his appetite and general condition were poor. He had



1. Case 1. **A.** Appearance of large sacral decubitus ulcer after preliminary local and systemic treatment. **B.** Photograph taken immediately after excision and plastic closure. **C.** Separation of tension area at midline. **D.** Result at 3½ months, after secondary plastic operation on right side. The small secondary ulcer developed after closure of a suprapubic cystostomy.

widespread visible edema below the waist, small bedsores over the trochanters and heels, and a 15 by 12.5 cm. sacral decubitus ulcer, which was undermined over the coccyx. A wide area of bare bone was exposed.

Examination of the blood showed a hemoglobin concentration of 9 gm., 3,900,000 erythrocytes, 12,000 leukocytes per cu. mm., and serum protein of 5 percent. Bacterial cultures of the open lesions yielded hemolytic and non-hemolytic streptococci, *Proteus vulgaris*, and *Bacillus subtilis*.

Systemic treatment was given to correct the patient's septicemia, anemia, hypoproteinemia, and avitaminosis. After a course of sulfathiazole, multiple transfusions, infusion of 25-percent human albumin, iron, vitamin concentrates, and a high-protein, high-vitamin diet, his general condition showed striking improvement, the edema disappeared, and the bedsores cleared up. Those on his heels epithelized, while the deep decubiti over the sacrum and trochanters narrowed in and developed healthy pink granulations, which carpeted the areas of exposed bone. Muscle tone was built up by a strenuous course of calisthenics in bed. Nevertheless his sacral decubitus showed no tendency to epithelize over a period of 6 weeks (fig. 1A). For this reason it was covered with pin-point grafts. These took nicely, but after 2½ months, when he was permitted to lie on his back and sit up in a chair, they broke down again.

During the next 6 weeks every effort was made to improve the thickness and resistance of the grafted area of sacral epithelium by ultraviolet light and gentle massage. In spite of these measures it continued to break down whenever he sat up in a chair. It was then decided to do a plastic excision of

the entire area and draw full thickness flaps of skin across the defect, which now measured 8 by 10 centimeters.

This operation was done on 10 November 1944, using a modified T-shaped incision as illustrated in figure 1B. Intramuscular penicillin was administered daily in eight 15,000-unit doses from 24 hours preceding the operation throughout the convalescence. The plastic repair healed by first intention, except for a narrow separation of the flaps in the middle of the longitudinal portion of the incision and at the extreme right lateral end of the crossarm. An error was made in removing all of the sutures on the thirteenth postoperative day, so that further separation took place in these areas (fig. 1C). These were closed by a secondary plastic procedure on 13 January 1945, reopening the vertical and right lateral incisions and undermining only a limited area.

This healed cleanly, leaving a satisfactory scar and mobile full thickness skin over the sacrum (fig. 1D). At the time this photograph was taken the suprapubic cystostomy had been closed and the patient was forced to remain temporarily on his back in bed while the wound healed. This resulted in the breaking down of a small pressure area of skin, 1 cm. in diameter, over the right posterior superior spine. At this writing, 2 months later, the patient is able to be up all day in a wheelchair and is starting to walk with hip-leg braces and the aid of crutches. His back is now nicely healed.

Profiting from this experience, no time has been wasted with preliminary epithelial grafts in the other patients, but the entire defect has been closed by sliding in flaps of full-thickness skin and subcutaneous tissue.

Case 2.—A Marine private, first class, during the invasion of Saipan in June 1944, was struck by a shell fragment over the eleventh thoracic vertebra. The wound caused immediate paralysis of the legs and the lower abdominal muscles. The shell fragment was removed by probing. Upon his arrival at this hospital on 28 November, the patient's general condition was fair; the hemoglobin concentration was 83 percent and the serum protein 6 percent. He had complete spastic paralysis of the legs and lower abdominal muscles with sensory loss to a point just below the umbilicus. The bladder, drained by an indwelling urethral catheter, was mildly infected, containing alkaline urine and many calcium phosphate and oxalate stones. A cystometrogram revealed good vesical tone and a low capacity.

There was a 7-cm. sacral decubitus ulcer with the coccyx widely exposed and undermined in its lower angle. Spinal x-rays revealed a fracture of the head of the rib and transverse process of the eleventh thoracic vertebra on the left side. Bacterial cultures revealed *Staphylococcus aureus* and a profuse growth of *Pseudomonas aeruginosa*.

Preliminary treatment consisted of a high-protein, high-vitamin diet, chemotherapy, tidal drainage of the bladder, and frequent periods of calisthenics in bed. After a period of 3 weeks, when the granulations had become healthy in appearance and the patient was accustomed to lying in the prone position, plastic excision and closure of the decubitus was carried out. This was done on 22 December by undermining H-shaped transverse flaps and sliding them in until they came together in the midline.

One hundred-twenty thousand units of penicillin were injected daily from the day preceding the operation, and the incision healed well except for a 2-cm. separation at the lower end of the midline suture. Excision of a decubi-



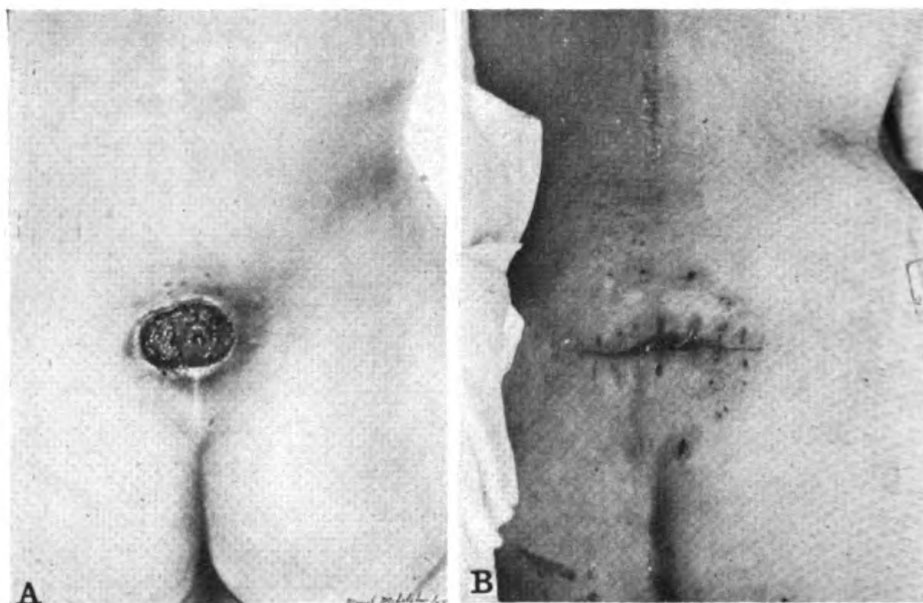
2. Case 2. Result 11 weeks after initial plastic closure. The extent of the original ulcer is indicated by the dotted line.

tus exceeding 7 cm. in diameter, in spite of wide undermining of the flaps, entails considerable tension at the midline suture, and the stitches in this area pulled through. In a month the flaps were firmly healed, with the exception of a central 2- by 3-cm. superficial defect with a bed of clean granulation tissue. On 29 January 1945 this was covered by a free full-thickness graft, glued in position by thrombin-fibrinogen mixture and sutured at the edges with fine silk.

Although its superficial layer became necrotic and desquamated, the deeper portion remained viable and the entire area had epithelized within a month (fig. 2). The patient was then able to be up in a chair for long periods. A recent bout of severe urinary sepsis following the crushing of his vesical calculi necessitated a prolonged period in bed, during which a portion of the secondary full-thickness graft, 1 cm. in diameter, broke down. This healed without difficulty as soon as the patient's general condition improved.

Case 3.—A Naval officer, age 22 years, was blown 20 feet into the air as a result of an explosion when his ship struck a mine. He was unconscious for a few minutes, and on awakening found that his legs were paralyzed. A compression fracture of the twelfth thoracic vertebra was treated by hyperextension in a plaster jacket for 3 weeks. When the plaster was removed there was a small bedsore over the lower sacrum.

On admission to this hospital on 24 January 1945, 3½ months after his injury, he was in good general condition, without evidence of malnutrition or sepsis. His paralysis was of the flaccid type, with complete loss of sensation up to the eleventh thoracic vertebra on the right side and to the first lumbar vertebra on the left. He had an automatic bladder, which emptied itself frequently and nearly completely, but forced him to keep a urinal between his legs. The sacral decubitus, measuring 4 by 5 cm., was covered with poorly vascularized granulations and had a sinus near its center, leading down to the sacrum (fig. 3A).



3. Case 3. **A.** Sketch of sluggish sacral bedsore with sinus leading down to sacrum (preoperative). **B.** Postoperative photograph taken 2 weeks later.

A period of 6 weeks was devoted to stimulating the bed of granulation tissue to resume active growth and the skin edges to grow in. During this period the patient was up in a wheelchair most of the day, but learned to sleep in the prone position. Despite a high-protein, high-vitamin intake, and local ultraviolet ray therapy, his decubitus ulcer showed no tendency to heal. Therefore the entire area was excised under the protection of penicillin on 13 February.

An elliptical incision, 10 cm. in length, was made transversely, and flaps of skin and subcutaneous tissue were undercut and sutured together with very little tension. This placed the line of suture as far away from the anus as possible. Except for a 2- to 3-mm. crusted area, some 2½ cm. in length, the entire area was healed in 2 weeks, when the photograph shown in figure 3B was taken. The skin edges have united in a fine scar with no retraction of the underlying subcutaneous fat, and the patient is now learning to walk with the aid of leg braces and crutches.

Case 4.—An officer, age 23 years, had his spinal cord transected by a 3-mm. shell fragment which passed between the laminae of the sixth and seventh thoracic vertebrae.

On admission to this hospital on 20 January 1945, about 3 months later, he had a complete motor-sensory paralysis below the eighth thoracic spinal segment, with moderate spasticity but fair automatic bladder function. He was not anemic or poorly nourished, but a sacral bedsore which originally measured 4 by 7 cm. had been partly covered by thin epithelium, leaving an open superficial central area, 3 by 5 cm. in extent. After 2 months of systemic and local treatment there remained an ulcer, about 1½ cm. in diameter, which refused to heal. In addition the surrounding epithelium was so thin that it constantly threatened to break down.

On 22 March, under the protection of penicillin, the entire area of scar with its thin epithelial covering was excised by an oblique elliptical incision, its edges undermined, and the flaps sutured together without undue tension.



4. Case 5. Postoperative photograph 4 weeks after excision and plastic closure. Prior to operation the undermined area was some 6 centimeters in diameter and the superficial defect 3 centimeters.

Although the postoperative convalescence was complicated by a superficial hematoma which caused the central portion of the suture line to separate, there has been no complicating sepsis. At 6 weeks the edges have drawn together, giving a satisfactory end-result.

Case 5.—A seaman, first class, age 41, suffered a cauda equina paralysis when his ship was torpedoed in September 1944. The hatch cover on which he was sitting was blown off with such force that he received a depressed fracture of the sacrum, with extensive but incomplete paralysis of his sacral nerves and of the bladder.

On arrival at this hospital on 15 January 1945 he was in poor general condition, with the serum protein reduced to 5 percent and with a secondary anemia. A suprapubic cystostomy, from which the catheter had been removed, was closing. He had an automatic bladder which functioned poorly at first, and a badly infected decubitus ulcer in the partially anesthetic area over his sacrum. This lesion had undermined an area some 8 cm. in diameter, and had a 3-cm. opening over the upper sacral spines, through which bare bone of the sacrum and patches of sluggish granulations were visible.

A period of 2½ months was spent in building up this patient's general condition and muscle tone. Necrotic sloughs were trimmed away from the large ulcerated cavity. Under local and systemic treatment with penicillin the granulations became pink and started to fill in the extensive undermined defect. At the end of this period the surface of the sacrum was covered and

the undermined area had shrunk to about three-quarters of its original size, but then seemed to remain stationary.

At operation on 2 April it was necessary to use a general anesthetic because parts of the excised area had intact sensation. A narrow segment of skin and granulation tissue was excised from the edges of the defect. By means of undermining, chiefly on the right side, and making an incision superiorly and laterally on the right side, it was possible to develop a flap, rotate it about 20 degrees, and obtain closure without tension. Double-zero plain catgut was utilized to approximate the subcutaneous tissues, and vertical mattress sutures of fine silk were employed to close the skin. Mechanic's waste was used for a compression dressing. The patient did extremely well, and when the cutaneous sutures were removed, the entire area was healed. Figure 4 illustrates the result 1 month after operation.

This article has been written as a preliminary report to bring to attention the possibility of performing plastic closure of large sacral bedsores. This can be carried out as soon as the anemia, protein loss, and avitaminosis have been corrected. Up to this stage, no more extensive local surgery should be attempted than trimming away sloughing necrotic tissue and draining outlying purulent pockets, as the factors listed above inhibit normal healing of the tissues.

A final word about the technic of preparing these flaps is also in order. This concerns the need for suture without tension. In both the first two cases there was partial separation of the skin edges, which necessitated secondary lesser plastic procedures. We are now searching for better methods of cutting the flaps so that they can be slid in and sutured at the midline with total freedom from tension. The operation described in case 5 represents a step in the right direction. It is believed that when this technical problem has been solved, it will be possible to close sacral bedsores exceeding 10 cm. in diameter and also large decubiti over the greater trochanters. Lesions in these areas have been a difficult problem owing to motion and lateral tension.

SUMMARY AND CONCLUSIONS

1. Sacral bedsores can be resected and closed by primary suture.
2. This method is applicable to indolent ulcers of the type commonly seen after severe injuries to the spinal cord.
3. In these cases adequate preliminary treatment must be given to correct anemia, reduced serum protein with edema secondary to malnutrition, and avitaminosis. Systemic and local chemotherapy should be used to clear up sepsis in the tissues surrounding the decubitus, in the bladder, or in any other focus.
4. If the area does not fill in with granulation tissue and a satisfactory growth of epithelium fails to cover the surface, ex-

cision of the entire lesion and plastic closure is preferable to pin-point or Thiersch grafting.

5. This can be carried out without fear of serious sepsis if penicillin is injected intramuscularly during the period of healing.

6. Five case histories are reviewed. In two of these there was primary healing; in the other three there was some separation of the edges of the flaps. Two of the latter required secondary plastic procedures of lesser extent. Sepsis was no problem in any case. In place of an adherent avascular scar with a thin covering of epithelium, which generally results from pin-point or Thiersch grafting, these patients all obtained full-thickness skin with a healthy layer of subcutaneous fatty tissue as a covering of the pressure area over the sacrum.

7. Even after a pressure sore has been excised and covered with full-thickness skin and subcutaneous tissue, it can break down again under the unfavorable circumstances which may arise in patients with transverse lesions of the spinal cord. In the after-care of these patients the same precautions must therefore be observed as in any case of anesthesia of the weight-bearing areas.



HISTORY OF B COMPLEX

An introductory survey of the vitamin B complex showed how, nearly 20 years ago, it had been found, mainly in work with rats and pigeons, that when sources of the original "water-soluble B" were heated until their antineuritic properties were lost, certain other nutritive properties remained. This led to the postulation of two vitamins. The heat-labile factor was described as vitamin B₁; the second factor was termed vitamin B₂. It was soon found that riboflavin, a yellow fluorescent substance isolated from milk whey, and now known to be very widely distributed in living tissues, could restore growth in animals restricted to diets deficient in vitamin B₂. The responses were not complete, however, and it became obvious that other factors were involved. Thus on treatment of concentrates of vitamin B₂ with charcoal and other adsorbents some factors were adsorbed while others passed through into the filtrate. The list of the better known members of the complex includes: *Heat labile*, vitamin B₁; and *heat stable*, vitamin B₂, which resolved into *adsorbed factors*, riboflavin, nicotinamide, and pyridoxine; *filtrate factors*, pantothenic acid, p-aminobenzoic acid, inositol, and choline; *unclassified factors*, biotin, folic acid, and grass-juice factors.—REPORTS OF SOCIETIES: The vitamin B complex. Brit. M. J. 1: 744-745, May 26, 1945.

APPENDICITIS, WITH EMPHASIS ON THE USE OF PENICILLIN

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The introduction of chemotherapeutic agents, particularly penicillin, has resulted in many changes in surgical practice. Carbuncles are no longer excised, empyemas are often successfully treated by aspiration and introduction of penicillin, and now our attitude toward certain problems arising in connection with acute appendicitis may require revision.

In order to evaluate the role of surgery in the treatment of acute appendicitis, it is necessary to correlate the pathologic changes in the appendix and adjacent viscera with the clinical course of the disease. And above all, it is essential to remember that *appendectomy is designed, not to treat appendicitis, but to prevent peritonitis*. If operation entails greater hazard of causing or disseminating peritonitis than is inherent in the natural course of the disease, then surgery is contraindicated.

When a young man develops generalized abdominal or epigastric pain which subsequently localizes in the right lower quadrant of the abdomen, it is preponderantly certain that appendicitis is the cause of the symptoms. Unfortunately, however, many cases of appendicitis do not follow this pattern. Diagnosis of appendicitis is therefore not always easy, and to be certain that acute appendicitis was not being overlooked, the abdomens of nearly all patients with abdominal pain would have to be explored.

The mortality rate of appendectomy for chronic appendicitis, or for an interval operation following an attack of acute appendicitis, is by no means negligible. For this reason every patient with abdominal pain cannot be operated upon indiscriminately. We are then faced with the question of whether the mortality will be higher if most patients with abdominal pain are explored, or whether it is safer to operate only on such patients as it is felt reasonably certain have acute appendicitis, even at the risk of missing an occasional case in which the diagnosis is obscure. Since penicillin has become available it is probably safer to discriminate as much as possible, and to operate only upon such

patients as appear to have convincing signs and symptoms of acute or chronic appendicitis. It is also probable that operation performed after the infection is no longer localized to the appendix entails greater hazard than does conservative therapy.

There are two types of appendicitis, the inflammatory and the obstructive. Inflammatory appendicitis appears to be a disease of lymphoid tissue much like acute tonsillitis. Like tonsillitis it is, in the great majority of cases, a self-limited but often recurrent disease. Complications may occur in this type of appendicitis, just as a peritonsillar abscess may occur in acute tonsillitis, but the majority of cases subside spontaneously without complication.

Acute inflammatory appendicitis runs a typical course. The patient develops abdominal pain which, unlike that of obstructive appendicitis, may often originate in the right lower quadrant. The initial changes are inflammatory and not obstructive. The localized irritation of the parietal peritoneum may not be antedated, as in obstructive appendicitis, by obstructive symptoms referred to the central part of the abdomen. Nausea and vomiting may occur, the temperature is elevated to 99° or 100° F., and there is a leukocytosis of from 12,000 to 18,000. Pain persists for from 12 to 48 hours and then subsides spontaneously. Tenderness in the right lower quadrant of the abdomen persists for 2 or 3 days. After 5 days there is usually no residual sign or symptom of appendicitis.

This is the natural course of the majority of cases of acute inflammatory appendicitis. Mild cases of obstructive appendicitis will follow the same course and subside spontaneously unless complications occur. Even after the symptoms are gone and the patient feels well, operation may reveal what appears to be an acutely inflamed edematous appendix covered with fibrin. This is a healing or subsiding appendicitis. If left alone it will subside completely and later will probably again undergo episodes of acute inflammation. The streptococcus, staphylococcus, and the coli-aerogenes group are the organisms responsible for these attacks.

This type of appendicitis is essentially a cellulitis of the wall of the appendix. The lumen of the appendix does not tend to be distended or filled with pus as is the case in the obstructive type. The danger is that the organisms will be of sufficient virulence or the resistance so low that the cellulitis will spread to involve adjacent tissues and that peritonitis will ensue. Fortunately the greater the invasiveness of the organism, the greater the probability of its sensitivity to penicillin. Another consideration is the fact that when virulent organisms are present there tends to be a rapid invasion of the cecum and adjacent tissues so that appen-

dectomy does not eliminate the infection. Appendectomy under such circumstances would be comparable to amputation of a finger when the cellulitis involves the entire hand. One must rely under such circumstances on rest and chemotherapy.

Mechanical appendicitis is the result of obstruction of the lumen of the appendix by a fecolith. Ulceration of the mucous membrane by pressure necrosis may occur and allow infection to penetrate the wall of the appendix. The organisms involved in this type of appendicitis tend to be the normal inhabitants of the intestinal tract, streptococci and *Escherichia coli*.

The cellulitis associated with this type of appendicitis is less marked than that seen in the infectious type because the organisms tend to be less invasive and virulent. These organisms are likewise less susceptible to control with chemotherapy.

As the tension within the lumen of the appendix increases, and as inflammation and pressure necrosis gradually weaken its wall, there develops a tendency to perforate. But before the wall becomes weak enough to allow perforation it must be acutely inflamed or necrotic. This takes time and during this time protective mechanisms are at work to wall off and localize the inflammatory process.

Is there a definite time when an appendix perforates? Occasionally there is, but usually the appendix does not rupture or perforate in the sense that a duodenal ulcer perforates; an appendix gradually disintegrates and as it does so, it is walled off. Abscesses form first in its wall, then extend to the space between the appendix and the next loop of bowel or omentum, and finally a periappendiceal abscess is formed which communicates with the lumen of the appendix by means of a fistulous tract.

It is not often that one sees an appendix perforated into the free peritoneal cavity. The so-called "perforated appendix" is usually a periappendiceal abscess, the walls of which are ruptured during the removal of the appendix. The abscess may be in the mesentery of the appendix or it may be between the appendix and adjacent structures. But the contamination incurred in the removal of this type of appendix comes not from the lumen of the appendix but from the abscess around the appendix.

Occasionally free perforations into the peritoneal cavity are seen. Most frequently these perforations occur in fulminating cases which perforate within 24 hours after onset of the attack. These are the exception, not the rule, and the longer the duration of the attack, the more opportunity the defenses will have had to wall off the inflammation, and the less likelihood there is of finding an appendix perforated into the free peritoneal cavity.

The question then arises as to whether there is any advantage to be gained from removing an appendix after it has "perforated." Assuming that the appendicitis is of the fulminating variety and the appendix has perforated into the free peritoneal cavity within 24 hours of the onset of the attack, will removal of the appendix at this stage prevent the spread of peritonitis?

These questions can best be answered by posing another: How often is there encountered at operation any evidence that there has been an actual discharge of fecal material from the appendix into the peritoneal cavity or into an abscess? The fecolith that was responsible for the attack is often found encysted in the remains of an absorbed abscess when interval appendectomies are performed, but it is doubtful that fecal matter from the cecum is discharged from a ruptured appendix.

The situation in a perforated appendix is not analogous to that encountered in a perforated peptic ulcer where the contents of the stomach are discharged continuously until the opening is closed. The lumen of the appendix is so swollen by inflammation that the discharge of feces is blocked, and the inflammatory reaction around the cecum has so stimulated the protective mechanisms of spasm and ileus that the ileum is no longer passing on its contents to the cecum. For these reasons continued contamination of the peritoneal cavity by fecal matter from the cecum does not occur as long as no cathartics are given.

If fecal contamination need not be considered as a hazard, should we not be concerned lest the appendix become gangrenous and act as a focus for the spread of infection?

The term "gangrenous appendix" is loosely used. A gangrenous appendix should imply that the appendix is dead beyond hope of recovery. Often the pathologic changes of acute suppurative appendicitis will be misdesignated as gangrenous and may give a false impression as to the frequency of this condition.

A gangrenous appendix is black or yellowish-green. It is rare that the entire appendix is gangrenous; usually only the tip or a spot of pressure necrosis over the fecolith can be correctly designated by this term. That this is true is borne out by the fact that it is rare, in performing an interval appendectomy even after most severe attacks of appendicitis, that the appendix is found to be missing. Usually it has reconstructed itself in an amazing manner and gives little gross evidence of the severity of the infection. Acute inflammation frequently so distorts and discolors structures that their survival seems impossible; yet after the infection has subsided the part returns to normal.

It has been observed that:

1. In the majority of cases, acute appendicitis is a self-limited disease that subsides spontaneously with conservative therapy.

2. If the virulence of the organisms causing appendicitis is high, the sensitivity of these organisms to penicillin is also apt to be high.

3. If the appendix has perforated into the free peritoneal cavity, the damage is done and no further contamination by discharge of fecal contents need be feared.

4. Since it is rare that the major portion of an appendix is gangrenous to the point that it dies and sloughs away, it is of little avail to remove a "perforated" appendix in the hope of eliminating necrotic tissue.

When appendectomy is indicated and when it is contraindicated, then, depends upon an estimation of the pathosis that will be found, remembering that the purpose of the operation is to prevent peritonitis.

It is nearly impossible to correlate clinical signs or laboratory data with the pathologic changes of acute appendicitis. The wide variations in the reactions of the individual and the various locations of the appendix in reference to the anterior abdominal wall are highly misleading. Often a patient with relatively early acute appendicitis, with little or no extension of the infection to surrounding tissues, will have a high leukocyte count and a rigid abdomen. Conversely a ruptured appendix may give only minimal symptoms and signs. A leukocytosis has been observed of 39,000 from an unruptured appendix, and one of 10,000 in fulminating appendicitis with rupture into the free peritoneal cavity.

Time is the most consistent factor influencing the pathologic changes of appendicitis. In the first 24 hours there is little doubt that surgery is the ideal treatment of acute appendicitis. It is rarely that free perforations or abscesses are found when operation is performed within 24 hours of the onset of symptoms. Under these circumstances complications are rare, recovery is prompt, and the patient is free from the threat of recurrent attacks of the disease.

In the next 24 hours, i. e., from 24 to 48 hours after the onset of symptoms, complications of appendicitis will be encountered more frequently. At this stage the disease tends to be at the peak of its severity. After 48 hours, if complications do not occur, the attack gradually subsides. Usually up to 48 hours it is still possible to remove the appendix without rupturing an abscess and contaminating the peritoneal cavity. Occasionally, in the more severe cases, contamination will occur.

After 48 hours one of two things has usually happened. Either the attack is subsiding without complications, or less frequently, a localized peritonitis or walled-off abscess has developed. It is at this stage that it is questionable whether or not surgical intervention is of value. If the attack is subsiding, little is gained by operative intervention and it is obviously preferable to wait and remove the appendix later. If the appendix has not as yet "ruptured," the chances of its perforating into the free peritoneal cavity are minimal, because after 48 hours or more it is nearly certain to have been walled off.

If a periappendiceal abscess is present, it is quite certain that this abscess will be ruptured and that the peritoneal cavity and the wound will be contaminated during removal of the appendix. And finally, if the appendix has perforated into the free peritoneal cavity, it is probable that the damage has been done and that no benefit can be expected from removal of the appendix.

In severe cases of appendicitis with perforation into the free peritoneal cavity or with formation of periappendiceal abscesses, what is the natural course of the disease? Does it progress to a generalized peritonitis or does it tend to remain localized? Even without chemotherapy it probably remains localized in most instances. It is possible in civil life, when cathartics are taken indiscriminately for abdominal pain, that the natural defensive barriers are broken and that generalized peritonitis more often, but still rarely, ensues.

Several patients were seen who developed acute appendicitis at sea where facilities for appendectomy or the administration of penicillin were not available. There were also men who stubbornly refused to turn in and who allowed their appendixes to perforate before reporting to the sickbay. Although two of these patients developed abscesses which eventually required extraperitoneal drainage, none of them died. Nor did any of them ever appear as sick as those who entered the hospital at a comparable stage of development of the disease and were subjected to appendectomy. Sulfathiazole was the only therapy used.

Penicillin in doses of 30,000 units every 4 hours appears to be slightly more effective than the sulfonamides in controlling infections of appendiceal origin. Even with this dosage the temperature trend of a patient with a pelvic mass has been seen to be reversed and the mass to resolve completely without drainage. In general, however, 30,000 units of penicillin, six times daily, will not prevent the formation of intraperitoneal abscesses.

When large doses of penicillin are given, there appears to be

quite a different result. One hundred thousand units given intramuscularly every 2 hours for 2 days, then 50,000 units every 2 hours for 2 days, followed by 50,000 units every 4 hours for 2 days, and finally 25,000 every 4 hours for 2 days—a total dosage of 4,500,000 units in 8 days—will usually control peritonitis and allow complete resolution of the infection without formation of abscesses. The high initial dosage is important in mixed infections so that the penicillin-neutralizing function of the *Escherichia coli* can be overcome. The slow tapering off of the medication is also important, because if it is discontinued abruptly, after 2 or 3 days the infection commonly recurs. In such cases the trend may be again reversed by administration of large doses of penicillin.

Little is known of the therapeutic possibilities of the larger doses of penicillin. The drug has been so scarce and costly that it has not been widely used in enormous doses. In vitro experiments indicate that the *coli aerogenes* group of bacilli is not susceptible to treatment with penicillin, but clinical evidence is accumulating that the larger doses are effective in controlling mixed infections. This phenomenon may be explained less on the basis of a direct effect on the bacillus than on overcoming the neutralizing effect that the bacillus exerts against the drug. It is entirely likely that the *coli aerogenes* bacilli themselves, in pure culture, are not highly pathogenic or invasive, and that the danger of mixed infections comes not from the colon group so much as from the cocci that are associated with it. By controlling these organisms, penicillin in large doses may control peritonitis or effect resolution of an inflammatory mass.

Twenty-five patients with extensive contamination of the peritoneal cavity have been treated with doses of 100,000 units of penicillin every 2 hours for 1 or 2 days and have subsequently received diminishing doses on the schedule outlined above. One of these patients had a resection of the sigmoid for acute diverticulitis with perforation; two others had resections of the sigmoid for perforated carcinomas, and one had a closure of a duodenal ulcer 24 hours after perforation (the ulcer was found to be gaping open and discharging intestinal contents at the time of the operation). Eight of the patients had "perforated" appendixes of more than 48-hour duration. They were admitted with signs and symptoms of "generalized" peritonitis and operation was deferred. The last thirteen had free perforations into the peritoneal cavity, or periappendiceal abscesses which were ruptured at the time of operation with extensive contamination of the peritoneal cavity.

All of these patients have recovered promptly and there were no intra-abdominal complications and no residual abscesses. One

of the patients developed a small perirectal abscess, arising from an infected anal crypt, during the course of treatment with penicillin. This, with the infections that developed in the wounds of the two patients with perforated carcinomas of the colon and the two with perforated appendixes, indicates that although penicillin may protect the peritoneal cavity, it does not afford complete protection against mixed infections in areas of low resistance. The wound infections develop late and are not accompanied by the usual amount of cellulitis.

RESULTS IN 1,500 APPENDECTOMIES

During the past 18 months, more than 1,500 appendectomies have been done on enlisted personnel at the U. S. Naval Hospital, San Diego, with but one death. The patient who died did not have acute appendicitis and at autopsy was found to have had an infected intra-abdominal hematoma arising from the appendiceal artery and causing a more or less generalized peritonitis. This patient was lost before we began to use the larger doses of penicillin in the treatment of peritonitis. There were no deaths in unoperated cases of appendicitis.

What is the explanation of the extremely low mortality rate (less than 0.1 percent) in this series?

The technic is standard: Spinal anesthesia is used, a McBurney incision is made, the stump of the appendix is not inverted, and No. 40 cotton sutures are used. Only when the appendix was not removed, or when a rigid cavity was encountered, was the peritoneal cavity drained. Sulfonamides were only occasionally used locally.

The skill of the surgical staff cannot be given full credit for the results obtained, because nearly 70 percent of the appendixes were removed by interns under supervision, or by young surgeons under instruction.

Analysis showed that 50 percent of the appendixes removed were red, swollen, and covered with fibrin or were described as "gangrenous;" 20 percent were described merely as acutely inflamed, 5 percent were perforated, and 25 percent were either chronically inflamed or inactive. At least 65 percent of these patients had true acute appendicitis.

The three most important factors in this low mortality rate are: (1) Early diagnosis—the majority of these cases were seen within 24 hours of the onset of symptoms; (2) the youth and health of these patients; and (3) the fact that only an occasional patient had taken a cathartic after the onset of symptoms.

In addition, credit must be given to other factors. Chemotherapy has unquestionably saved the lives of several patients in this series. The record of sulfonamides implanted locally has not been impressive, and since penicillin has become available their use has been largely abandoned. Sulfathiazole and sulfadiazine given systemically in full doses unquestionably did play a part in controlling infection by certain highly invasive organisms, notably the hemolytic streptococcus.

Penicillin in the usual doses of 30,000 units every 3 or 4 hours likewise proved beneficial, but in many of these cases, as in the patients treated with sulfonamides, convalescence was complicated by the development of localized intra-abdominal abscesses. These complications appear to have been avoided when the larger doses were employed. Although the series is still too small to allow conclusions to be drawn, it seems that penicillin, given in adequate doses over a long enough time, promises to control peritonitis due to mixed infections from the gastro-intestinal tract. On several occasions intra-abdominal masses which developed during the administration of penicillin in doses of 25,000 or 50,000 units every 4 hours resolved completely when 100,000 units were given every 2 hours.

Finally, it is believed that a conservative attitude toward the complications of appendicitis has been responsible in no small part for the low mortality in this series. Most patients with severe attacks of appendicitis of more than 48 hours' duration have been managed conservatively and operation has been deferred for a month or longer. Gastric suction was used if vomiting or distention occurred, and at the slightest indication of intestinal obstruction a Miller-Abbott tube was passed. On one occasion when the Miller-Abbott tube could not be passed beyond the pylorus, it was necessary to operate for relief of intestinal obstruction. In this case the patient had a pelvic appendix which had ruptured a week before. The peritonitis was subsiding satisfactorily when a loop of small bowel became obstructed. His postoperative course was stormy for several days but he recovered.

Postoperative complications, such as pelvic abscesses or abscesses in the right lower quadrant of the abdomen were managed conservatively until these pointed. Drainage was then accomplished either by inserting the finger through the rectal wall or by re-opening the old incision. In every case, including one subdiaphragmatic abscess, drainage was obtained without contamination of the peritoneal cavity.

Often when the wounds were badly contaminated, the peritoneum was closed without drainage and the wounds were packed

open with plain gauze. Some of these wounds were closed by secondary suture of the skin from 3 to 20 days later, depending on whether or not infection occurred. No attempt was made to suture the muscle or fascia and no subsequent weakness of the abdominal wall was noted.

In view of the excellent results that can be obtained by the conservative treatment of appendicitis with modern chemotherapeutic agents, serious consideration should be given to the question of whether or not appendectomy is indicated aboard small ships where equipment is limited and there is only one medical officer. It is questionable whether the mortality rate from appendicitis would not be higher under these circumstances than if the disease were treated conservatively with large doses of penicillin.

SUMMARY

1. Penicillin in large doses (100,000 units every 2 hours intramuscularly) appears to have a definite effect in controlling peritonitis due to appendicitis or to perforations of the large bowel. This effect is much more striking than that seen with smaller doses.

2. In the majority of cases appendicitis is a self-limited disease that subsides spontaneously and completely after 48 hours.

3. The majority of so-called "ruptured" appendixes are periappendiceal abscesses which are ruptured during the removal of the appendix.

4. If the appendix has ruptured into the free peritoneal cavity, it is unlikely that operation will improve the patient's chances of recovery.

5. After 48 hours the pathosis of acute appendicitis is subsiding appendicitis, periappendiceal abscess, or localized peritonitis. At this stage serious consideration should be given to the advisability of operating.

6. A series of 1,300 appendectomies with one death is reported.

7. The low mortality rate is attributed to early diagnosis, the youth of the patients, the rare use of cathartics, the liberal use of chemotherapy (especially penicillin), and conservative treatment of many cases of appendicitis seen 48 hours or more after the onset of the attack.

8. The question is raised, whether in view of the efficacy of treatment with large doses of penicillin, the risk of appendectomy at sea on small ships is not greater than that of conservative therapy.

PRIMARY HEALING FOLLOWING EXCISION OF A CYST, TERATOMA

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The failure of wounds to heal by primary intention following excision of a cyst, teratoma (pilonidal cyst), has brought forth various surgical technics. The period of hospitalization and loss of duty from these cases frequently exceeds that of the common surgical disabilities. This difficulty in healing may tend to influence the surgeon away from wide excision of the area or even toward conservative temporizing procedures.

There are three fundamental reasons for lack of primary healing of these wounds.

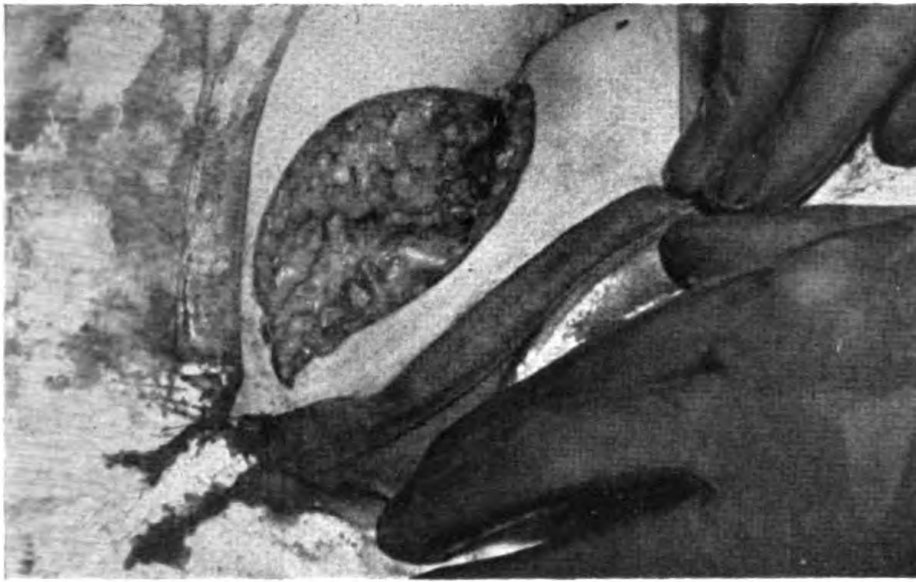
1. Incomplete block excision of the cysts and tracts.
2. Inability to obliterate the "dead space" or cavity in the depth of the wound, with resulting accumulation of bloody exudate and secondary infection.
3. Difficulty in rendering this area sufficiently aseptic for primary closure.

The first of these problems is overcome if the surgeon is mindful of the pathologic characteristics of the lesion, particularly the tendency for the midline dimpling to be some distance from the cysts, the existence of accessory tracts without cyst formation, and lastly, the multiplicity of cysts often into the buttocks, where accurate preoperative palpation is difficult and discovery is made at the time of surgery when the lesion is inadvertently cut across.

The second problem, to obtain complete obliteration of the cavity overlying the sacral floor, is the primary purpose of this presentation. In order to accomplish closure of the elliptical operative defect (fig. 1), three surgical maneuvers are carried out.

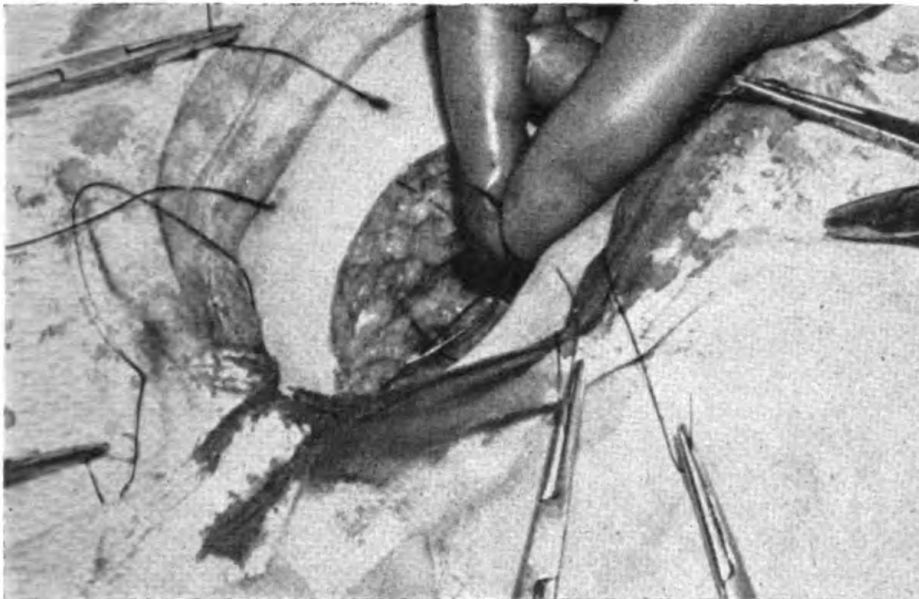
1. Through-and-through heavy nonabsorbable sutures are inserted to the depth of each side of the wound with rubber tubing threaded on one end and the suture left untied (fig. 2).

2. A small rubber tissue drain is placed along the floor beneath the sutures as a safety valve for the inevitable exudate, and emerges from the upper end of the wound where a more nearly aseptic condition is maintained (fig. 3). This drain is loosened on the second day and some bloody serum usually exudes. As soon



1. Wide elliptical operative defect, the edges extending perpendicularly from skin to gluteal-sacral fascia. The block is excised from above downward on the fascial plane.

—Official U. S. Navy Photo.

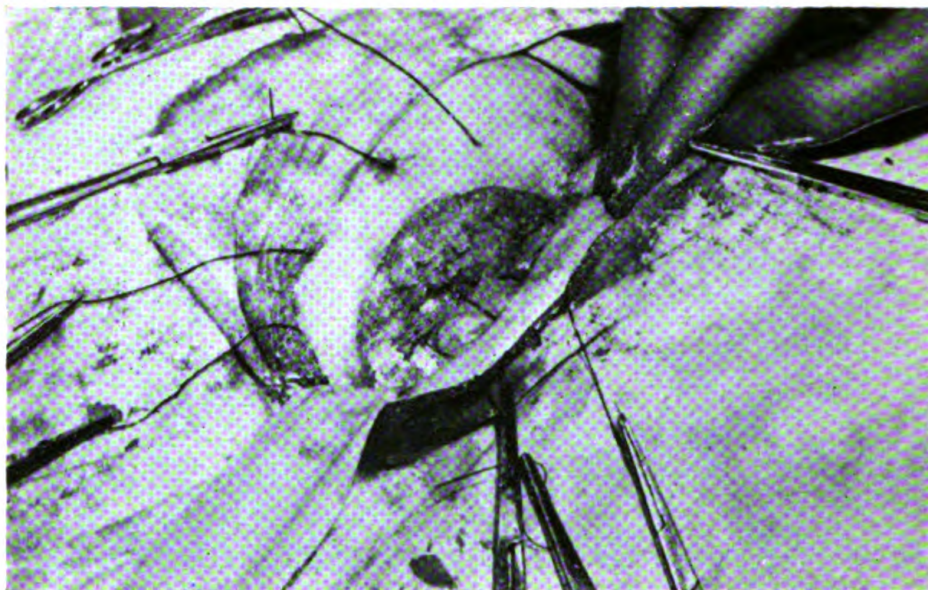


2. Through-and-through heavy suture reaching to the sacral fascia. Undercutting is not necessary; the cavity is obliterated primarily by overlying dressing.

—Official U. S. Navy Photo.

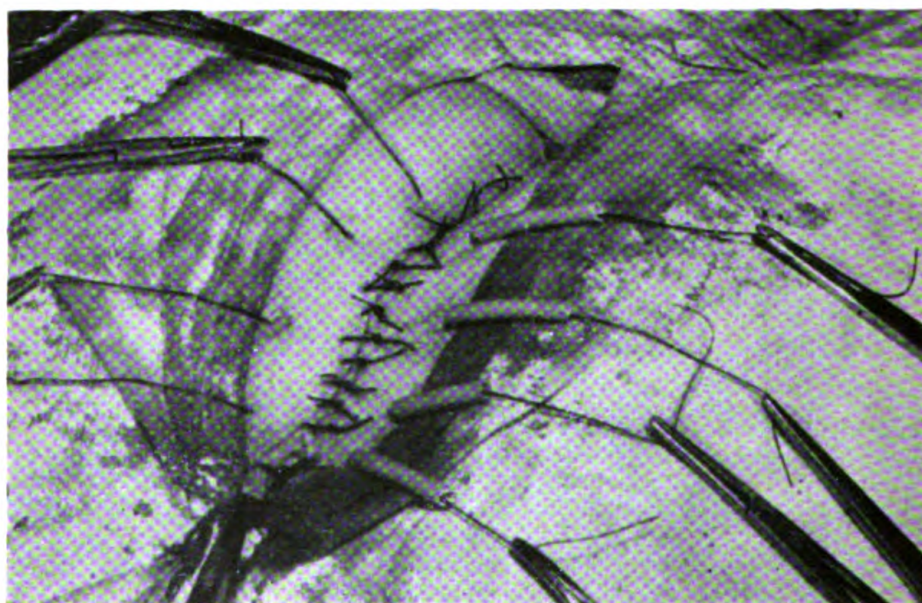
as possible, usually on the fourth or fifth day, the drain is removed if no serum retention exists.

3. After closure of the skin with carefully placed sutures to prevent overlapping of skin edges, particularly at the lower angle (fig. 4), a roll of gauze sponges, of sufficient diameter to fill the



3. Rubber tissue drain along depth of wound beneath sutures and emerging from upper angle as a safety valve. Sulfanilamide has been gently rubbed into the wound.

—Official U. S. Navy Photo.



4. Skin closure in preparation for overlying gauze roll. Rubber tubes threaded on tension sutures for support.

—Official U. S. Navy Photo.

gluteal fold, is laid on the line of suture and the through-and-through sutures are tied over the roll, using the rubber tubing for support (fig. 5). This maintains a constant pressure, obliterating the dead space regardless of how the buttocks are brought together by adhesive.



5. Gauze roll snugly held in place. Rubber tissue emerging beneath upper end of dressing. Adhesive strapping drawing buttocks apart during surgery has been loosened from the table and now is removed from buttocks.

—Official U. S. Navy Photo.



6. Completely healed incision 15 days postoperatively.

—Official U. S. Navy Photo.

As the gauze roll becomes saturated with drainage and dries, it becomes a rigid splint molded to the gluteal fold and held firmly by the deep sutures. This immobilization is maintained for from 8 to 12 days, depending upon the dryness of the wound. Upon the splint's removal, the soft tissues are firmly adhered to the underlying sacrum and primary closure is accomplished (fig. 6).

The third problem, that of rendering this area sufficiently aseptic for maintenance of such primary closure, brings up preoperative, operative and postoperative procedures.

Infection of the cyst must be minimal. It may be necessary to incise and drain even an apparently small cyst and await a later date for excision.

To avoid postoperative bowel movement contamination, and trauma from the bedpan, it is advisable that the intestinal tract be well evacuated preoperatively and a low-residue diet used subsequently.

Operatively the perianal area must be considered as a major source of contamination. Adhesive straps, pulling the buttocks apart, facilitate draping and wound exposure (fig. 5). Maximum hemostasis, using a minimum of fine catgut (00 plain), is best accomplished by suture ligatures.

After placing the tension sutures and drain, sulfanilamide is placed in the wound and gently rubbed until well moistened (fig. 3). Recently 10 cc. of penicillin solution (1,000 units per cc.) has been poured into the wound as suggested by Whitley.¹

No attempt is made to bind the buttocks tightly, although a secondary gauze dressing is applied. This can be changed without disturbing the primary dressing.

SUMMARY

1. A technic to allow closure and primary healing of most cysts, teratoma, is described. Attention is directed to wide block excision, obliteration of the dead space or cavity which will exist, and lastly, the use of every adjunct, including sulfonamides and penicillin, in the maintenance of maximum asepsis in a recognized area of contamination.

2. The necessity of buried suture is obviated except for a few fine (plain 00) suture ligatures. Judicious diathermy coagulation can make even these unnecessary.

3. Use of this technic has markedly decreased both hospitalization, morbidity, and the incidence of recurrence in this author's experience.

¹ Lieutenant Commander Ralph D. Whitley (MC) U.S.N. Personal communication.

PENICILLIN IN THE TREATMENT OF VINCENT'S ANGINA

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Vincent's angina presents a frequent problem in military medicine. Its infectivity enhanced under the crowded conditions in barracks and on shipboard even to the point of epidemic prevalence, the disease calls for the isolation of its victims, frequently in a hospital. Moreover the condition is not self-limited; it produces no immunity, and resistance is largely by means of phagocytosis and the local destruction of organisms. Therefore the infection tends to run a prolonged course unless it is subjected to active treatment. The therapeutic measures used heretofore, including the arsenicals, have not proved universally efficacious, so that hospitalization is often protracted and relapses are not uncommon. It therefore seems desirable to record our results with the use of penicillin, which not only proved to be curative but also greatly reduced the average number of sick days.

Forty-one patients with Vincent's angina were admitted to the communicable disease department of this hospital. In each instance the following diagnostic criteria were fulfilled: (1) A definitely ulcerated lesion. This appeared most frequently on the tonsil, at times on the gums, and usually had ragged overhanging margins and was covered with a grayish-yellow exudate. (2) A preponderance of Vincent's organisms in smears made from the ulcerated areas. This preponderance must be emphasized in diagnosis, since lesser numbers are at times to be found in smears from normal mouths. In making the smear the cheesy exudate is scraped aside with a swab and some of the underlying material is transferred to a clean slide by rolling the swab, not by rubbing, on the slide. (3) In each instance, diphtheria and agranulocytic angina were ruled out by smear, culture, and total and differential leukocyte counts.

Most of the patients had been under treatment without success

by dental and medical officers for some time before admission here. Nearly 50 percent gave a history of previous recurrent attacks. They were all young, averaging 23 years of age.

Except in one instance, penicillin was the only treatment used. Each patient received 20,000 units by intramuscular injection every 3 hours for 10 doses—a total of 200,000 units. Twenty-four hours after the last injection the lesions were inspected and smears taken. If the smear proved positive, the course of penicillin was repeated, even though the ulcer had apparently healed. No mouthwashes or topical applications of any kind were used. Patients were kept in isolation under routine measures for control of contagion.

The criteria for cure before discharge to duty were (1) freedom from symptoms, (2) healed lesions, and (3) a negative smear for Vincent's organisms.

Every patient experienced complete relief from symptoms, notably soreness in mouth and throat, and fever, within 24 hours of the completion of the first course of penicillin injections. In 29 patients the lesions had healed and smears were negative 24 hours after a single course of 200,000 units of penicillin.

In 11 patients the lesions had apparently healed, but the smear was still positive 24 hours after the first course of penicillin. They were given a second 200,000-unit course in the same way as before, following which the smears became and remained negative.

In one patient the lesions had greatly improved after administration of 200,000 units of penicillin and apparently healed after an additional 200,000 units. The smear, however, was still positive, so he was given a single injection of mapharsen (0.045 gm.), and the next day the smear was negative. This patient had ulcers extensively involving the gums and both tonsils, and he had been under treatment with various agents for months. It is our belief that cure could have been effected by a third course of penicillin and without the use of the arsenical.

The average period of hospitalization for the penicillin-treated patients was 7 days (5.4 days from the beginning of penicillin injection until discharge to duty). These figures are in striking contrast with an average of 23 hospital days for 197 cases treated by other methods in the preceding years.

It has been possible to follow only 10 of our patients; none of these has had a relapse. Of the others some, at least, were from shore stations which could have sent the patient back to us had there been a recurrence, but this has not happened. Yet previous to the use of penicillin such readmissions were not uncommon.

The data have been summarized in the accompanying table.

Clinical data in 41 penicillin-treated cases of Vincent's angina

	Area involved			Totals
	Tonsils	Gums	Gums and tonsils	
Number of cases involving.....	25	13	3	41
Cases cured by 200,000 units.....	15	11	3	29
Cases cured by 400,000 units.....	10	1	1	12
Average hospital days after start of penicillin.....	6	4.5	4.5	5.4
History of previous attacks, failure of other treatments..	13	4	1	18

SUMMARY

1. Penicillin proved highly successful in the treatment of 41 cases of Vincent's angina.

2. The majority (29) were cured by one course of 10 intramuscular injections of 20,000 units each third hour, totaling 200,000 units. This is probably the minimal dose for routine use.

3. The remainder were cured by a second similar course given a day later, or a total of 400,000 units.

4. The average number of hospital days for the penicillin-treated patients was 7, as compared with 23 for those treated by all other methods.



PENICILLIN TOPICALLY

The available evidence suggests that topically applied penicillin containing 500 Oxford units per cubic centimeter may not be sufficiently concentrated for optimum therapeutic effect in refractory chronic infections. Present pharmacologic purity and possible risk of establishing resistant strains of bacteria by selection justify an upward revision of concentration. Definite advantages have been found in the use of 4,000 units per cubic centimeter in isotonic solution of sodium chloride with 0.1 percent of the detergent sodium tetradecyl sulfate for local application to chronically infected areas of bone and soft tissue, and for the treatment of infected amputations. If experience in a larger number of cases confirms the efficacy of this simple procedure, it is possible that the magnitude of mutilating major surgical procedures for osteomyelitis may be substantially limited.—GRACE, E. J., and BRYSON, V.: Topical use of concentrated penicillin in surface-active solution. *Arch. Surg.* 50: 219-222, April 1945.

MEASUREMENT OF RELATIVE EXOPHTHALMOS BY ROENTGENOGRAPHY

BENJAMIN FRIEDMAN
Lieutenant Commander (MC) U.S.N.R.

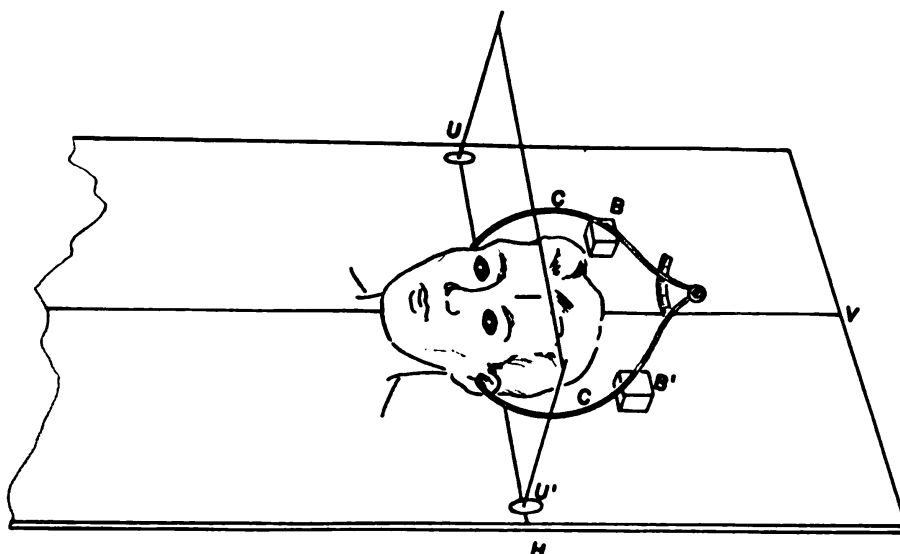
Clinical exophthalmometry is beset with difficulties. The exophthalmometer must be placed on exactly the same point of contact at each examination; the skin and soft tissues have a tendency to slip under the pressure of the instrument; there may be a natural inequality in the positions of the orbital margins relative to the corneal vertexes; a tumor or other deformity may be present at the point of contact, thereby introducing the probability of error; and lastly, there is a current insufficiency of satisfactory instruments.

The measurement of relative exophthalmos by means of x-rays is presented as follows: The patient lies on the x-ray table, with eyes looking straight upward; a contact glass carrying a small central lead dot is placed over each eye; the x-rays are directed from the foot end of the table so that the central ray passes through the lead dots at an angle of 35 degrees with the table; the shadows of the lead dots fall upon the film. If one eye protrudes more than the other, the dot on the relatively exophthalmic eye will be projected farther back than the dot on the less protruding eye.

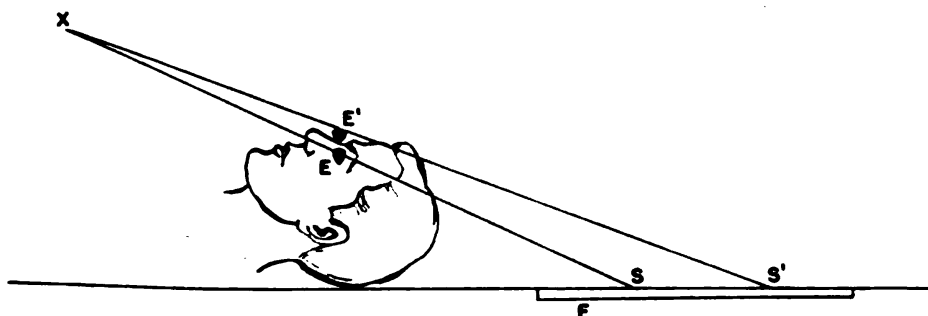
The chief problem is to position the eyes in space in such manner as to eliminate sources of error, and to permit duplication of this spatial position each time an exposure is made. These conditions must be fulfilled even though long intervals of time separate successive examinations of the patient.

A. The sagittal plane must be determined. In this connection the sagittal plane is defined as that plane which is the perpendicular bisector of the interpupillary line. With both eyes in the primary position, a ruler edge is placed so as to cover exactly the lead dots. Another ruler edge is held perpendicular to the first edge at the midpoint of the interpupillary line. A line is next drawn on the forehead along this vertical edge with a colored pencil. The colored line represents the position of the sagittal plane as it passes through the skull. The head is now placed on the table so that the sagittal plane coincides with the central etched line in the long axis of the x-ray table.

B. The patient's eyes are focused on a small ball which is sus-



1. **V** and **H** represent the longitudinal and horizontal lines etched in the surface of the x-ray table. **B** and **B'** are blocks supporting ball-tipped calipers, **C**, which are placed in the external auditory canals. **U** and **U'** are uprights supporting a tight string which lies parallel to **H**.

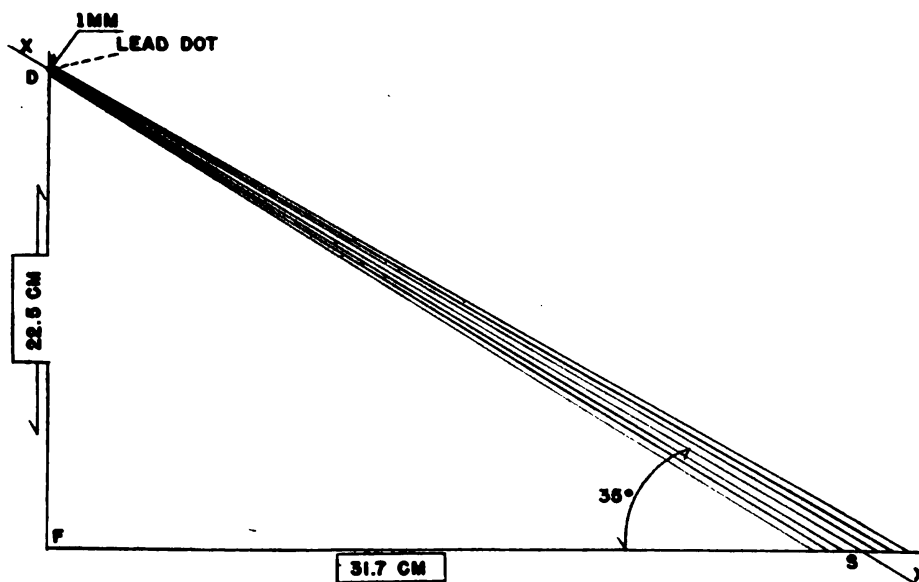


2. **E** represents the less protruding eye, **E'** the relatively exophthalmic eye. **X-S** and **X-S'** denote the passage of the rays through the respective lead dots, to cast their shadows on the film **F** at **S** and **S'**.

pendent in the midline, directly over the eyes, at a height of about 3 feet.

C. The interpupillary line must be perpendicular to the central ray. Another etched line running crosswise is to be found on the table; the lead dots must be made to coincide with this line, or with a line drawn parallel to it. This is done by stretching a string taut between two movable uprights and then sighting with one eye so that the string is parallel to the crossline on the table. The head is now gently moved so that the lead dots are sighted directly under the string.

D. The sagittal plane must be made to fall perpendicular to the table top. This is done in the following manner. A pair of wooden blocks is placed near the patient's head. The tops of the

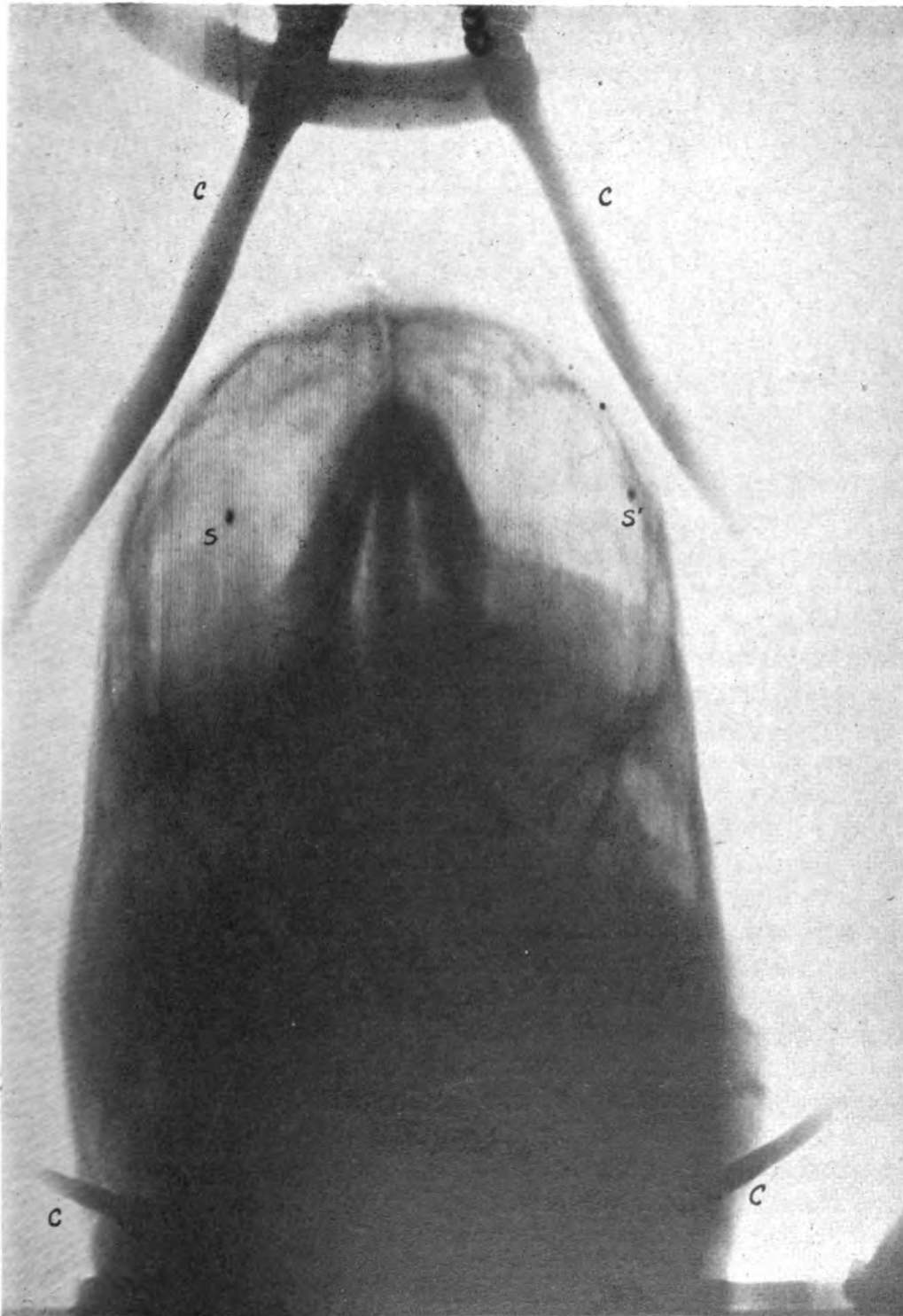


3. **D** represents the lead dot on the patient's eye, in this case 22.5 cm. above the film level **F**. **X-X** represents the path of the central ray through the dot **D**, at an angle of 35 degrees, to cast a shadow on the film at **S**. The dot **D** is displaced upward and downward in the drawing, in steps of 1 mm., and the paracentral rays are shown as they pass through these displacements to cast their respective shadows at various distances from **S**.

blocks are trued to a horizontal position by means of a spirit level. A pair of obstetrical calipers is rested on the blocks, with the joint just over the longitudinal etched line on the table. The ball ends of the calipers are carefully inserted into the patient's external auditory canals. The patient is instructed to roll his head very slightly to either side, that is, around the vertical axis of the skull, until the pressure of the ball tips is equal in both ears. The canals are surprisingly sensitive to inequalities in pressure, and only very slight motion is required to effect equalization. A rubber band is placed around the caliper arms near the joint, to produce a constant gentle pressure. The arms of the calipers must not be sprung; both ball tips must lie in a plane parallel to the block surfaces. It is assumed that when a line joining the external auditory canals is parallel to the table top, the sagittal plane will fall perpendicular to the table, and this assumption has been justified by experience.

E. The distance from the tip of the chin to the table top, the mouth being closed, is measured and recorded. The measurement is performed with a graduated upright which carries a sliding horizontal arm. Subsequent examinations of the patient are made with the chin lifted to the recorded height.

The central ray of the tube is tilted to make a 35-degree angle with the table, and is directed through the sagittal plane (colored



4. Roentgenographic findings in unilateral exophthalmos. **S** represents the shadow of the right dot, **S'** the shadow of the left dot. **C** denotes the calipers. In this case the left eye was displaced forward and laterally by a mass in the nasal wall of the orbit. The lateral displacement of the dot is obvious. Perpendiculars are dropped from **S** and **S'** to the bottom of the film and measured.

line). The tube is brought forward until the central ray passes through the level of the lead dots. The film is then moved so that the central ray will strike at about the center. The head is stabilized by an adjustable compression band which is a standard accessory to the x-ray table.

SOURCES OF ERROR

1. One eye may be situated higher in the skull than the other. The lead dot over the higher eye will be projected farther back than the dot over the lower eye. This source of error is nullified by step C.

2. The head may be rotated on its vertical axis, tilting the sagittal plane away from the perpendicular, and thus bringing one eye closer to the table and moving the other farther away. This source of error is nullified by step D.

3. One side of the skull may be more developed than the other, so that the eye on the more developed side will lie farther forward than its fellow. This will cause the lead dot on the relatively overdeveloped side to be projected farther back. However the relation between the orbital margin and the corneal vertex need not necessarily be different from that of the other side, and this may be checked by the exophthalmometer. If the gross appearance of the skull suggests a unilateral overdevelopment, and the exophthalmometer fails to register a relative exophthalmos, the x-ray findings may be discounted accordingly. Similarly a finding of exophthalmos with the exophthalmometer which is not verified by x-ray may be assumed to be due to an unequal development of the orbital margins and is not a true exophthalmos.

Figure 3 shows the measured distances in one particular case, drawn to scale. D indicates the lead dot as it lies over the cornea, and X signifies the path of the central ray as it passes toward the film. The adjacent rays represent the displacement of the shadows when the dot is theoretically raised or lowered in steps of 1 millimeter. It will be noted that the displacements on the film are not quite equal, but become slightly greater with each successive elevation of the dot. However the average displacement on the film is about 4 mm.; that is, each millimeter of exophthalmos is magnified about four times. The height of the lead dot above the table will vary somewhat with each patient. For that reason we cannot state that a given number of millimeters of projection difference on the film is equivalent to an exact number of millimeters of exophthalmos, but the approximate ratio of 4:1 is close enough to be of clinical value. The readings should be regarded as being relative rather than absolute.

Film measurements are made by dropping a perpendicular from the center of each dot shadow to the proximal edge of the film. For practical purposes the difference in the lengths of these perpendiculars represents the relative exophthalmos magnified four times. The longer perpendicular belongs to the exophthalmic eye.

The contact glasses are standard plastic lenses such as are ordinarily used for purposes of refraction, with a corneal diameter of 7.5 mm. and a scleral diameter of 25 millimeters. The lead dots are 1.5 mm. in diameter. The dots are placed directly over the pupillary centers. The lenses are handled with the usual rubber suction grip. They are extremely easy to insert while the patient is in the supine position. No fluid is needed between the cornea and the lens. One drop of anesthetizing solution is sufficient. Visual acuity remains ample for fixation. Once the x-ray team has become familiar with the steps, an examination can be accomplished in from 10 to 15 minutes.

The method is precise. Readings on successive examinations may vary from 0 to 2 millimeters. This represents an actual discrepancy of from 0 to 0.5 mm. of ocular position. This, in most cases, is less than the variations found in repeated readings with the exophthalmometer. It measures relative, not absolute exophthalmos. For example, if both eyes were equally exophthalmic, there would be no unequal projection of the respective shadows. This method cannot be expected to supplant instrumental exophthalmometry, but it offers additional information in equivocal cases. The two methods should supplement and check each other.

The contact lenses were supplied by Mr. Ernest Obrig, Jr., of the Contact Lense Service, Inc., 551 Fifth Avenue, New York.



SULFADIAZINE IN CORYZA

The average duration of the sulfadiazine-treated colds was 8.1 days, and that of the untreated colds 9.7 days. Of the 48 colds treated, 32 showed no recognizable secondary infection; 16 developed sinusitis, bronchitis or both, either during or after sulfadiazine treatment. Patients who developed complications, however, felt that they were milder in character than they would have been without the drug. The patients who received sulfadiazine were asked for their own opinions on the results obtained, and 34 expressed satisfaction with sulfadiazine treatment. Nine stated they noticed no difference from previous colds. The remainder had no opinion to offer.—CECIL, R. L.: Chemotherapy in acute upper respiratory infections. Bull. New York Acad. Med. 21: 263-277, May 1945.

DERANGEMENTS OF THE KNEE JOINT

DIAGNOSTIC AID OBTAINED BY THE ROENTGENOLOGIC EXAMINATION
OF THE SOFT STRUCTURES AND OF THE MENISCI
WITHOUT INJECTION OF CONTRAST MEDIA

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The x-ray diagnosis of knee joint injuries calls for a thorough understanding of the normal morphology of the soft structures and of the mechanisms which produce internal derangements of the knee joint. In addition to a careful history and physical examination, it is desirable to extend the diagnostic scope of the x-ray examination to include new technics particularly designed for the study of the soft structures.

Fractures of the internal meniscus frequently are oblique and incomplete, running horizontally through the cartilage, so that the fractured portions move upon one another like scissors blades. This may lead to a false joint formation later. A segment of a torn cartilage may become detached and act as a loose body, but locking is not caused by such loose detachments alone. It also can occur by impaction of a hypermobile, fractured segment between the articular surfaces. A longitudinal fracture may involve a portion or the whole length of the cartilage, usually near its periphery. If this is associated with a transverse tear, the free ends of the fracture junction may turn up and act as pedunculated tags, producing symptoms like those produced by loose bodies.

The bucket-handle type of fracture is the result of a longitudinal tear with medial displacement of the medial fragment, which often is displaced into the intercondylar notch. This semidetached centrally placed fragment may undergo attrition and division because of constant friction, and the two pedunculated segments thus formed may cause intermittent locking, which disappears gradually as these loose tabs undergo further reduction in size. Dislocation of either cornu may take place with this type of fracture. Subluxation or hypermobility of the entire cartilage is not uncommonly the cause of symptoms resembling true rupture of the meniscus, a condition prone to occur in young women. Complete uncomplicated dislocation of either meniscus must be very rare, but partial dislocation or peripheral detachment in conjunction with fracture of the meniscus is a frequent occurrence.

In the acute stage of injury to either meniscus, an effusive

synovitis usually occurs, but a chronic synovitis may follow due to the chronic irritation set up by the displaced cartilage. Each attack of locking may be followed by synovitis, and in time fibrosis develops in the synovial membrane, interfering with absorption of the recurrent effusions and leading later to fibrous adhesions. Hypertrophy of the synovial villi and of the infrapatellar fat pad is apt to follow, and cartilage may form in these villi. These cartilaginous villi may ossify and become detached to form loose bodies. Osteoarthritis can mark the end-result of such changes. This is the most potent argument for early operation.

TABLE 1.—*Internal derangements—age incidence in 387 Naval recruits*

Years	Number of patients
10-19.....	104
20-29.....	181
30-39.....	68
40-49.....	23
Over 50.....	11

TABLE 2.—*Accidents causing locking of knee joint*

Activity	Number
Football.....	65
Drill maneuvers.....	8
Basketball.....	7
Fall.....	5
Twist.....	7
Miscellaneous.....	12

The attachments of the menisci vary widely, an important factor influencing the symptomatology. One person may wrench his knee severely without displacement of the cartilage, whereas another may have a displacement with ordinary use on a staircase or on the dance floor. The congenital anomalies naturally produce symptoms early in life, and those that appear in childhood are apt to be due to these early developmental irregularities. The external disk undergoes these transitional interruptions more frequently than the internal disk.

The highest incidence of symptoms occurs in the age group between 15 and 25 years (table 1). It would be natural to expect such a distribution of age groups in the military services, but it so happens that this distribution is similar to that reported in civilian practice.

Athletic activity is the principal immediate cause of symptoms. In one series of cases analyzed at a Naval training center, football, basketball, and drill maneuvers were the three principal fac-

tors which led to the onset of symptoms. The source of material to be analyzed has a bearing on such findings. This is exemplified by Martin's (1) figures, indicating an incidence of 62.8 percent injuries of the internal meniscus in miners, and only 18 percent among football players. His patients were mostly miners who work in low galleries characteristic of the British coal mines. These miners are forced to work in a kneeling position with the toes turned out, putting a strain on the tibial collateral ligament with loosening of the internal cartilage. When the loosened cartilage is caught between the articular surfaces, symptoms are produced.

Among American miners, as pointed out by Henderson (2), the incidence of internal derangements is not so great as among English miners because they work in seams of greater height and so can remain in the erect position. In this country football probably is the most common activity causing derangements of the knee-joint.

The intensity of the initial symptoms varies greatly. The onset may be very severe, due to a marked concomitant damage of the ligaments at the time of the accident; or the initial symptoms may be slight, with locking not appearing in the picture until late in the course of the disease, perhaps not until a recurrent attack after much stretching of the ligaments has taken place. In most cases, locking is the most prominent symptom from the beginning. In connection with the symptom of locking, a careful consecutive history is most important; otherwise no satisfactory evaluation of the symptom can be obtained. The patient might not be able to furnish a good history of the accident because of its sudden and precipitous onset. In cases in which the initial symptoms are severe, such as those caused by a fall, a direct blow, or torsion, the onset of pain is sudden, often accompanied by a sensation of a snap or a slipping of the joint.

Locking may occur immediately, preventing complete extension or flexion, but this depends on the site of the meniscus tear. If the fragments of a fractured meniscus remain in situ without becoming interposed in some abnormal situation, locking is not apt to take place; occasionally locking may occur, but the limited motion of the joint might be ascribed erroneously to the effusion, pain, and spasm by which it is overshadowed. Limitation of motion is immediate and sudden when due to locking, whereas it comes on gradually when it is due to effusion, pain and spasm. Conversely a sudden unlocking is characteristic of a released interposed torn meniscus, whereas gradual restoration of full knee motion is associated with resolution of synovial effusion and abate-

ment of spasm. In cases that occur on the football field, the incidence of true locking is relatively high; that from other accidents such as a fall, a blow or a twist, is relatively low (table 2).

Tenderness is localized over the site of the torn portion of the meniscus, whereas the tenderness which may be found with effusion is usually not localized. There may be local tenderness over a torn tibial collateral ligament or over a localized contusion. In the presence of synovial effusion, which accompanies so many of these local injuries, it is difficult sometimes to elicit localized tenderness, so that the differential diagnosis of a torn meniscus may not be easy, especially in the early stages or when there is no history of locking.

There is a group of cases in which the original injury is minor and the symptoms are mild, but as the condition progresses and recurrences take place, the attachments of the semilunar cartilages gradually stretch. Locking may then occur, sometimes preceded by intermittent attacks of pain and effusion. This sequence of symptoms is not infrequently encountered in professional athletes or in those who have given insufficient attention or treatment to the initial sprain.

In another group of cases, there may be a history of locking during the initial episode, with only a slight reaction following the spontaneous unlocking of the joint; but recurrence of locking may take place after various intervals, sometimes with severe but often with mild reactions, depending on the degree of stretching of the attachments of the menisci. As the cartilage becomes more and more detached, recurrences of locking with pain and swelling may become more frequent, until finally the patient seeks relief by radical surgical measures. This is particularly true of bucket-handle fractures, when instead of a history of intermittent locking, a snapping and jerky movement of the joint may be the prominent complaint.

There is a small group of cases in which neither the history nor the physical findings would lead one to suspect the presence of a ruptured disk, yet at operation this is precisely what the surgeon finds. One always must be prepared for this kind of a surprise, despite the greatest care with the taking of the history and with the management of the physical and x-ray examinations. In a group of 61 operated cases, where ruptured disks were found, locking was a prominent symptom in 65 percent, but not all these patients presented this symptom at the time of the initial injury. Fisher (3) found the symptom of locking in 75 percent of all cases, but only as an initial symptom in 40 percent of cases with internal derangements of the knee joint.

Much care must be exercised in taking a history and the smallest details may prove to be of utmost importance in reaching a correct diagnosis. The patient's story should be arranged chronologically and all remissions and relapses reviewed carefully. The picture thus obtained may be the only way an interpretation of the physical and x-ray findings can be achieved.

The physical examination should include observation of the gait, and as part of the examination both knees should be included; otherwise a slight degree of incomplete flexion or extension easily can be missed. The discovery of effusion is not difficult if the supra- and parapatellar depressions are observed carefully. A click or a snap, heard or felt during flexion or extension, is a valuable diagnostic finding. A tear of either meniscus may cause this, but the external cartilage is the one usually involved. In 34 operated cases in which a click or a snap was found, only in 8 cases was the internal meniscus involved; the other 26 cases revealed some form of injury of the external meniscus.

If a cartilage has been fractured transversely, it may form an external prominence. In these instances the anterior portion tends to straighten from its incurled position and thus protrudes anteriorly, where it can be palpated. Other causes for external swelling may be an anterior detachment of the meniscus, or a pedunculated flap from the concave margin of the disk or the handle of a bucket-handle tear, fractured transversely and displaced anteriorly. Simultaneous with actual palpation of an injured cartilage may be heard a distinct snap or a click as the leg is extended, flexed or rotated. If undue lateral mobility is present, a stretched lateral ligament may be the cause, and in the case of a coexistent tear of the anterior cruciate ligament, increased anteroposterior mobility of the joint may be found.

The possibility of injury, either simultaneously or consecutively, of both cartilages, always must be remembered, even if the signs are localized or only present on one side of the joint. With damage to the anterior horn of the internal meniscus, there is frequently an associated injury of the inner alar fat pad. When all the symptoms of internal derangement are present except that of locking, damage to this fat pad alone might be the explanation. This pad may become thickened and fibrous in chronic cases in which there has been a series of injuries, each associated possibly with synovitis and effusion. Adhesions might form eventually which would call for treatment different from that for internal derangement of the knee joint.

Cartilaginous cysts may be another cause for external swelling, and a history of trauma may or may not be obtained. These

swellings are sometimes painful and may change in size and shape during flexion and extension. Most of these cysts are situated over the middle of the outer surface of the external cartilage. Bristow (4) believed that trauma plays no part in their causation and concluded that they represent degenerative cysts comparable to ganglia, arising in the synovial and extrasynovial fatty and areolar tissue as well as in the fibrocartilage. These cysts may be confused with Baker's cysts.

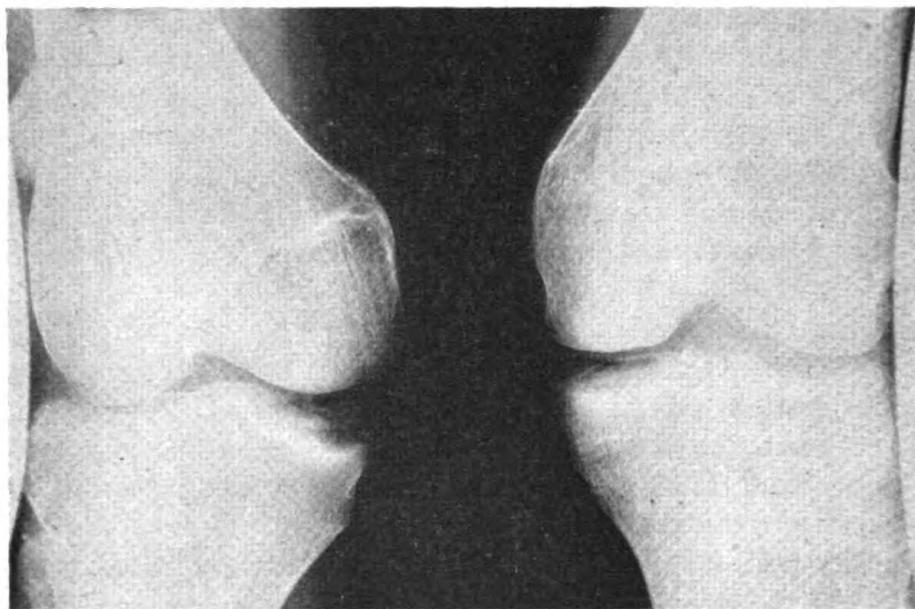
Among the other conditions which must be considered in the diagnosis of internal derangement of the knee joint is rupture or sprain of the tibial collateral ligament. Injury to this ligament results usually in the occurrence of immediate pain on the inner aspect of the joint. Locking is absent unless there is a concomitant displacement or fracture of the inner meniscus. If hemorrhage occurs, local swelling results immediately and this may be localized or diffuse, either inside or outside the capsule.

Sometimes patients cannot recall the occurrence of immediate swelling, which they will maintain came on slowly some hours after the accident. This is plausible because often the symptoms at first appear minor. For the same reason the original injury may be treated inadequately and this may be an important factor in the recurrences. A minor twist or turn is sufficient to bring on a recurrence with sudden giving way of the joint, which then may be followed by swelling. A chronic condition may supervene leading to the evolution of a chronic arthritis. This results in the appearance of other symptoms, such as the presence of increased abduction of the leg and increased thickening of the tibial collateral ligament due to fibrosis and ossifying periostitis.

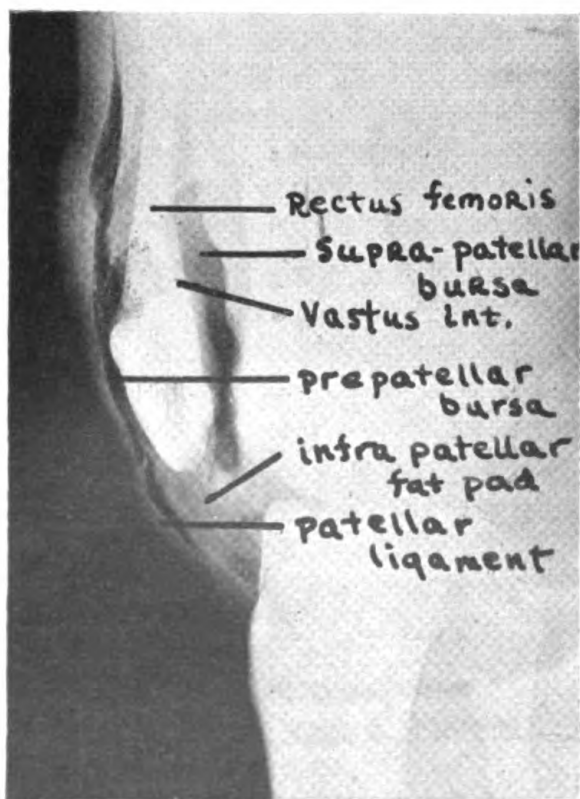
With some injuries the periosteum may be torn where the ligament is attached. This is true more of its femoral than of its tibial attachment. The subsequent calcification which results close to the cortex of the inner femoral condyle resembles the condition which has come to be known as Stieda-Pellegrini disease.

ROENTGENOGRAPHIC EXAMINATION

The introduction of the Coolidge tube brought with it a black-out of the wealth of soft-tissue details characteristic of the roentgenographs exposed with the early gas tubes; and with the use of our present viewing equipment came a self-imposed limitation in visualization of soft-tissue shadows. This has led unwittingly to a limited use of the x-ray examination in derangements of the knee joint, because in this condition which implicates chiefly such soft structures as the menisci, ligaments, and synovia, there is



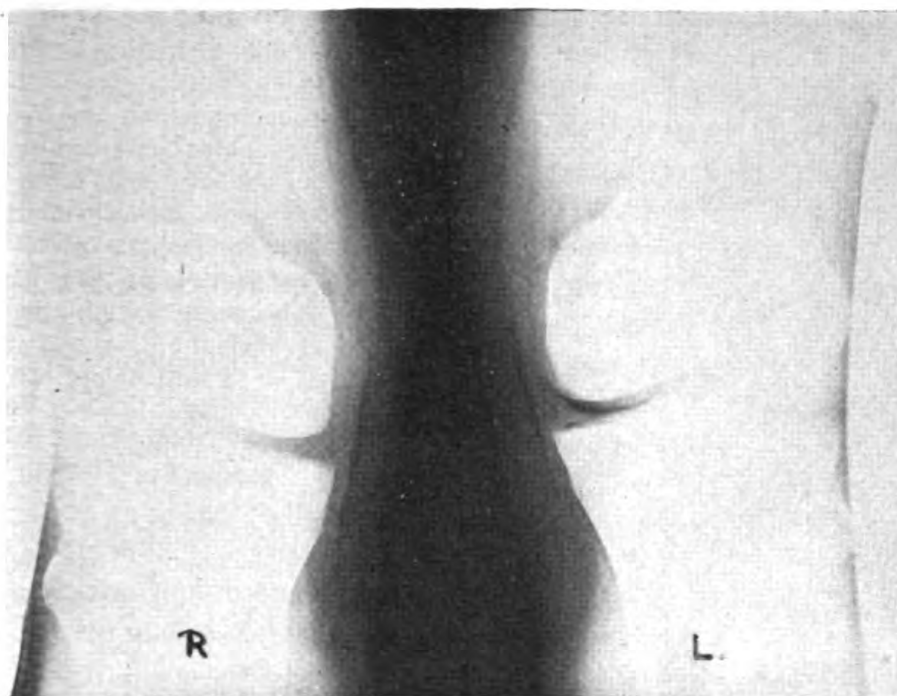
1. Normal menisci in vacuum technic films.



2. Arthrography for "diagrammatic" visualization of soft structures which may be seen in ordinary x-ray films of the knee.

little value in the x-ray examination unless these structures are selected particularly for study.

Most of these shortcomings might be corrected merely by improving the present system of transillumination of our x-ray



3. Internal derangement of the right knee joint. On the day previous to examination, temporary locking had occurred in a football accident. The x-ray findings are: (1) Swelling of the synovia; (2) slight excess synovial fluid indicated by failure to demonstrate the meniscus in the injured knee, while on the healthy side the meniscus could be shown; (3) the absence of evidence of injury to other soft tissue or bony structures of the knee.

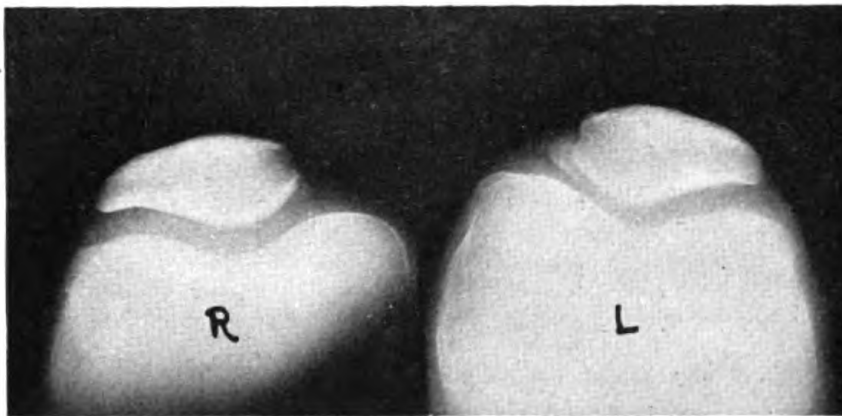
4. Chronic sprain of the tibial collateral ligament. The x-ray findings are: (1) Slight swelling of the upper portion of the tibial collateral ligament in the region of its attachment to the inner femoral condyle; (2) no excess of synovial fluid as indicated by demonstration of the meniscus; (3) absence of evidence of injury or disease in the other soft tissue or bony structures.



films. Already some manufacturers have made available view boxes which have wide ranges of brilliancies, making possible visualization of soft-tissue structures not discernible with clarity when examined in ordinary films with viewing equipment now in use. If improvements in this direction go far enough, we may find it unnecessary to adopt special x-ray technics in the future



5. Chondromatous synovitis with laminated loose bodies. Locking of the knee joint often is caused by loose bodies simulating the major symptom of internal derangement of the knee joint. The x-ray examination can establish the diagnosis if all projections are used.



6. Osteochondritis dissecans. This condition involves usually the lower articular surface of the inner femoral condyle, but any portion of the articular surfaces may be affected. In this case, the process involves the posteromedial surface of the patella, and this is seen best in the longitudinal projection. When the degenerated fragment becomes detached and gets caught between the articular surfaces, locking ensues as in internal derangement of the knee joint.

for demonstrating soft-tissue shadows; otherwise special x-ray techniques will have to be developed to meet this challenge.

In the roentgenograph of the knee, the following soft-tissue structures can be examined: The skin, the subcutaneous layer with its larger veins, the tendons of the rectus femoris, vastus internus and vastus externus, the patellar ligament, the infrapatellar fat pad, the gastrocnemius tendons, the hamstring tendons, the various bursae when distended with fluid, the articular car-

tilage, and finally, the menisci by a special technic of inducing a temporary vacuum in the joint space. By strong traction, abduction, or adduction of the leg, a transient vacuum can be created in the joint space, revealing the outline of the menisci. Since this vacuum cannot be created in the presence of excess synovial fluid (more than 8 to 10 cc.) (5), failure to demonstrate the meniscus may be interpreted as indicating the presence of slight excess synovial fluid, often not apparent by physical examination.¹ Thus synovitis with slight excess synovial fluid, which might escape detection by physical examination, is demonstrated easily by this technic.

This often makes possible the differential diagnosis between intra- and extracapsular swellings of the knee. If the meniscus can be shown in a knee which is swollen, the presence of synovitis and excess fluid in the knee is ruled out, and the swelling may be regarded as limited to the extracapsular structures. Demonstration of the meniscus may be used as the end point in following the resolution of a synovial effusion, because not until complete healing has occurred can the meniscus be shown.

The x-ray findings are more or less uniform in cases of internal derangement of the knee joint in spite of the wide variation in the physical findings. The swelling of the synovial membrane, and the slight excess fluid, which are both present in the acute phase, are seen readily in the lateral projection of the knee. The anterior displacement of the patella and the slight swelling of the suprapatellar bursa are obvious in the more severely injured cases. After mild injuries, the synovial membrane changes may not be revealed in ordinary films, and only by failure to demonstrate the meniscus in the vacuum technic films will the presence of slight excess synovial fluid become evident. This is so because in the presence of more than from 8 to 10 cc. of synovial fluid, it is impossible to create a vacuum in the synovial sac sufficient to demonstrate the meniscus.

Rarely does injury to a meniscus occur without concomitant injury to the ligaments, particularly the tibial collateral ligament. This invariably results in swelling of this ligament which can be visualized in the x-ray film.

In addition to these positive findings, the x-ray examination will help to rule out the presence of other causes for derangements of the knee joint. Unless at least three projections of the knee are available, namely, the anteroposterior, lateral, and longitudinal, the x-ray examination may fail to reveal important in-

¹ This may be the reason for failure to demonstrate the internal meniscus in 20 percent of normal knees. Both knees should be examined routinely.

formation. The longitudinal view of the knee, including the patella, is the only one which will reveal changes in either alar fat pad, the alar reflections of the synovia, many vertical fractures of the patella itself, and chondro-osseous sequestra of osteochondritis dissecans involving the posterior surface of the patella, not infrequently the cause for symptoms resembling internal derangement of the knee joint.

Foreign bodies or loose bodies, which so frequently cause locking of the knee joint, are not always easy to demonstrate, but they will be missed less frequently if all the projections of the knee are used as part of the routine x-ray examination. Oblique projections and special examinations made with the knee in partial flexion are necessary to reveal further valuable information. A cyst of the meniscus, Baker's cysts, and localized hypertrophies of the alar fat pads often are best demonstrated in oblique views. The use of the meniscus technic will help to determine whether these swellings are intra- or extracapsular.

Rupture of the tibial collateral ligament in the acute phase will in the x-ray films reveal slight swelling of the soft tissues about the knee, more prominent on the inner aspect, slight swelling of the synovial membrane and suprapatellar bursa, best seen in the lateral view, and absence of the meniscus shadow in the vacuum technic films. If the meniscus can be demonstrated, then it can be inferred that all the swelling is extracapsular. The x-ray diagnosis of injury of the tibial collateral ligament is made with ease in the chronic stage when only slight thickening of the tibial collateral ligament will be visible in the area of injury, but often it will be necessary to have films of the opposite knee for comparison before this thickening can be appreciated.

Increased lateral mobility will be evident in the meniscus films by the widening of the inner half of the joint space while the leg is held in abduction. This is frequently the most readily demonstrated finding in chronic cases, when there have been recurrences with stretching of the tibial collateral ligament. Slight atrophy of the vastus internus and rectus femoris is discernible occasionally, even when it is not detectable by physical examination.

Finally the absence of other abnormal roentgenographic findings is a great aid in the differential diagnosis. Rupture of the anterior cruciate ligament will disclose increased anteroposterior mobility, or slight hyperextension, or a fracture through the internal tibial spine; and if this fractured fragment becomes detached, locking may result, simulating closely a rupture of the meniscus on either side. The other causes for derangements which can be excluded by these x-ray studies are loose bodies, arthritis,

tuberculosis, tumors, hypertrophy of the infrapatellar fat pad, subluxation of the patella, foreign bodies, cysts of the meniscus, swellings of single bursa, and old healed traumatic arthropathies.

If the roentgenographic findings are fitted into the clinical picture derived from an accurate history and a thorough physical examination, an accurate diagnosis of the various derangements of the knee joint may be made, which is the *sine qua non* for effective treatment.

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BALANCED ANESTHESIA

To produce the muscular relaxation demanded by the surgeon when working in the upper part of the abdomen, it is necessary to give a large amount of any anesthetic agent. In the case of sodium pentothal intravenously, this relaxation is unobtainable without approaching much too closely a toxic dose. The use of inhalation agents such as ether or cyclopropane to produce adequate relaxation necessitates at least lower-second or upper-third plane, third-stage anesthesia. This level in a patient in poor condition is undesirable.

The combination of intercostal block with procaine hydrochloride and intravenous sodium pentothal in traumatic injuries of the abdomen produces an excellent anesthesia with minimal depression. Procaine hydrochloride has been used here in combination with sodium pentothal, nitrous oxide, cyclopropane and ether, and any patient who is operated upon should receive the benefits of the addition of intercostal block to the anesthesia if there is the slightest question of his ability to stand the anesthesia and operation, or if the abdominal relaxation desired by the surgeon will not be safely obtained with the anesthetic agent to be used.—BELINKOFF, S.: Intercostal nerve block in balanced anesthesia. *Am. J. Surg.* 68: 318-322, June 1945.

CHARACTERISTICS OF A DISCIPLINARY GROUP IN A NAVAL HOSPITAL

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The present study was undertaken to learn the salient characteristics of those patients in a Naval hospital who require disciplinary action. In the maintenance of discipline each Naval activity has its own unique problem, and a hospital is no exception. Breaches of discipline occurring in the highly specialized hospital setting are necessarily influenced by factors peculiar to that situation.

In a Naval hospital, officers are also doctors, and enlisted men are not only sailors and Marines, subject to all the regulations of the Navy, but are patients as well. The doctor-patient relationship is superimposed upon the basic military pattern. The situation favors laxity in discipline, unless the doctors are well indoctrinated in regard to their responsibilities as Naval medical officers. Another important element is the psychologic effect of illness and injury. Impaired health does not relieve a man of all responsibility, but it may and frequently does influence his behavior.

The findings presented here are based on an analysis of 233 disciplinary cases, all the subjects being enlisted personnel and all patients in a Naval hospital. Questionnaires and interviews were used as a means of studying this group. A comparable group of nondisciplinary cases was also studied. This control group was selected in such a way as to be representative of the hospital population as a whole.

BACKGROUND AND EARLY EXPERIENCE

One of our first interests was discovering whether patients in disciplinary difficulty are typical delinquents. Are they men who, out of uniform, might be expected to get into trouble with the authorities in civilian life?

Delinquents in civil life have certain well-known characteristics. Most of them are young, the critical age period being late adolescence and early maturity. Subnormal intelligence and educa-

tional deficiency are common. Many are unstable and manifest neurotic tendencies. Psychotic and psychopathic conditions are often present. Delinquents also have a habit of getting into trouble frequently. It was necessary to learn whether these same factors characterize the disciplinary group in a Naval hospital.

The first factor investigated was age. Twenty-five was found to be the average for the disciplinary group. Hospital patients in general, as represented by the control group, also had an average of 25 years. Extreme youth, therefore, was not a characteristic of patients in disciplinary difficulty.

Examination of educational background also failed to differentiate the disciplinary and control groups. Each group averaged a ninth-grade education level. Since this level of educational attainment requires average intelligence, intellectual inferiority could not be considered a characteristic of the disciplinary group.

The question of neurotic tendency and emotional instability among patients in the disciplinary group was investigated by means of a questionnaire. Fifty items, covering early neurotic traits and personality characteristics, formed the basis for evaluating the neurotic factor. The accuracy of these self-reports on early traits was verified for 100 selected cases, the information being acquired from independent sources in the course of routine hospital procedures.

Tabulation of scores on the questionnaires showed no difference between the disciplinary and control groups in the prevalence of early neurotic traits. Instability and neurotic tendencies, therefore, could not be considered characteristic of the disciplinary group.

A related question arousing investigative interest was the proportion of neuropsychiatric patients involved in disciplinary difficulty. Most of these neuropsychiatric patients were on open wards, and consequently had the same opportunity as other patients to get into trouble. A number were on locked wards, but this number was no larger, proportionately, than the number of non-neuropsychiatric patients confined to their wards by reason of illness, surgery, or quarantine. It was found, after considering the factor of segregation, that the proportion of neuropsychiatric patients in disciplinary difficulty was almost the same as the proportion of neuropsychiatric patients in the hospital. Neuropsychiatric conditions had therefore to be eliminated as a major cause of disciplinary infractions.

One of the outstanding characteristics of any group of civilian delinquents is the high proportion of habitual offenders among them. To learn whether this characteristic held true for the dis-

disciplinary group under study, frequency of arrests, juvenile court appearances, and reform school commitments were tabulated for both the disciplinary and control groups. No difference between the two groups was found. Pre-service delinquency was not characteristic of the disciplinary group.

Age, education, neurotic tendency, mental abnormalities, previous offenses—none of these major factors of civilian delinquency was found to apply to the disciplinary group studied. These men could not be considered a typical delinquent group by civilian standards.

The lack of resemblance between the disciplinary group and the typical pattern of civilian delinquency increased the interest in discovering the personality factors that did characterize the disciplinary group and that differentiated this group from the non-disciplinary control group. Accordingly, an item-by-item analysis was made of the pre-service personality traits of the patients in both groups.

Three clear-cut, highly specific differences were revealed: (1) More patients in the disciplinary group were found to be impulsive and quick-tempered, both in the opinion of the patients themselves and in the judgment of others. (2) In civilian life more of them had been inclined to argue and quarrel with their employers, and more of them had been dismissed from civilian jobs. (3) Difficulties with teachers and school authorities occurred more frequently among these patients than among the controls.

Defiance of authority was apparently a personality characteristic of these disciplinary patients. Early in life it expressed itself in the school situation. Later it appeared in a vocational setting.

Why didn't this defiance extend to civil and police authorities and make delinquents of these men? The answer appears to lie in the nature of their opposition. It was not a deliberate, bitter defiance of organized society. Their quarrels seem to have been of a more personal nature, the result of private differences of opinion. Quick temper, rather than premeditation, was the determining factor.

Patients involved in disciplinary difficulties, thus, are an essentially normal group. They are not typical delinquents. They differ from nondisciplinary patients in two respects. They are more impulsive, and they have a habit of opposition toward persons in authority.

SERVICE EXPERIENCE

Since the investigation showed comparatively little difference in the pre-service experience of patients in the disciplinary and con-

trol groups, we began to look for differences in the service experiences of these men which might explain the breaches of discipline.

Conceivably a number of factors in a man's service experience might play a significant part in influencing his behavior in the direction of disciplinary infractions. These include lack of indoctrination, length of foreign duty, combat duty ashore or afloat, branch of service, and dislike of service. Each of these aspects of service experience was investigated.

Length of service for patients in the control group was found to average two years. The average for the disciplinary group was almost exactly the same. This length of time may not allow for complete indoctrination in the Navy or Marine Corps, but a group in uniform this long cannot be considered new to the service. Lack of indoctrination does not explain disciplinary infractions in a Naval hospital.

Length of overseas duty also failed to differentiate between the disciplinary and control groups. About one year's duty outside the continental limits of the United States was the average for patients in both groups.

The possibility of being "soured" on the service was another important factor to consider. Some men get off to a poor start in boot camp and never hit their stride. Others nurse along a real or fancied grievance until they develop a pervading sense of resentment and frustration.

To get at the over-all effect of the service on the individual, a 33-item questionnaire was given to each patient. The information sought dealt with changes in attitudes and emotional reactions since entering the service. Did the patient feel more self-confident? More independent? Thwarted? Dissatisfied? Easily annoyed? In the administration of the questionnaire, appropriate measures were taken to insure unbiased answers, and checks were made on the reliability of the response.

Scoring of the questionnaires brought out an interesting fact. More patients in the disciplinary than in the control group felt that the service had affected them favorably, and that the changes which had taken place in their attitudes were beneficial.

Branch of service also proved to be a differentiating factor between the groups. A larger proportion of Marines was found in the disciplinary group than their percentage in the hospital warranted. In defense of the Corps it should be said that their offenses, in general, were not the most serious ones.

The most interesting difference between the two groups, by all odds, was the difference in amount of combat experience. Fifty percent more of the disciplinary group had been in combat. In

the service experience of the two groups this was the most significant difference found.

To insure understanding of the significance of combat as an element in disciplinary infractions, a number of the patients in this group were interviewed further. One of the most universal reactions found among these men was a feeling that they had done their share, at least for the time being. They felt entitled to certain rights and rewards. Chief among these, of course, were leave and liberty. They arrived at the hospital expecting leave at the earliest possible moment, confident they could convalesce much better at home. When, for any of a dozen good reasons, they could not be granted leave or liberty, the blow fell hard. In this connection it is interesting to note that over half of the infractions of the disciplinary group were those of AOL and AWOL.

Most important among the other characteristics of these men, because it is most likely to be overlooked, is the amount of psychologic readjustment expected of them. Many of them come directly from a combat zone to a Naval hospital. The time interval is small, but the difference in environment is great. Attitudes and emotional reactions appropriate to the one situation are inappropriate in the other. Habituation to the new surroundings takes a while, and during this psychologic shift, impulsiveness is likely to rule a large part of a man's behavior.

*Comparison of disciplinary and nondisciplinary groups in a Naval hospital**

Characteristics	Disciplinary group	Control group
<i>Similarities</i>		
Average age, in years	24.85	25.28
Average number of grades completed in school	9.7	9.9
Average score on neurotic-tendency questionnaire (low score indicates few neurotic traits)	4.3	5.2
Proportion of neuropsychiatric cases	**	**
Average length of service, in months	23.8	22.6
Average length of duty outside continental limits, in months	11.2	10.3
<i>Differences</i>		
Proportion who consider self quick tempered	61	46
Proportion who had trouble with employers and were fired from civilian jobs	24	13
Proportion giving history of trouble with school authorities	25	16
Average score on effect-of-service questionnaire (low score indicates person believes he has changed in a favorable or desirable way since entering service)	4.9	9.8
Proportion in Marine Corps	30	20
Proportion in Navy	70	80
Proportion who have been in combat	36	23

* Entries are in terms of means and percentages. Differences are all statistically significant; each is at least 2.57 of its standard error. Items listed as similarities all showed critical ratios of 1.00 or less.

** In compliance with a recent directive, actual figures are not given. There was, however, little difference between the two groups.

COMMENT

The majority of patients requiring disciplinary action in this hospital are not intrinsically difficult to guide.

An attitude of personal interest and understanding on the part of the officer administering discipline is highly essential. Bringing these patients' attention forcefully to the fact that they are members of a military service and that their country is still in a state of war, coupled with proper disciplinary action, usually suffices to bring about a change of attitude from that of obstruction to one of active helpfulness.

SUMMARY

A study of the characteristics of patients in disciplinary difficulty in a Naval hospital is presented here. A group of 233 of these patients, and a comparable nondisciplinary control group, were studied by means of questionnaires and interviews. Early background was examined, as well as the service experience of the patient.

Three general conclusions are supported by the findings of the study. (1) Patients in disciplinary difficulty in a Naval hospital are not the typical delinquents of civilian life. (2) Their outstanding personality characteristics are impulsiveness and opposition to authority. (3) The differentiating feature of their service experience is greater frequency of combat experience.



EMERGENCY SUBSTITUTE FOR DARKFIELD MICROSCOPY

When a darkfield condenser is not available aboard ship the following staining procedure permits excellent visualization of luetic organisms. All of the constituent reagents are aboard almost any vessel.

1. No antiseptic applied to the suspected chancre.
2. Warm saline compresses applied for 10 minutes and all scabs and surface debris gently removed.
3. Clear chancre exudate transplanted onto clean slide, and resultant smear fixed by passage over alcohol flame.
4. Smear covered with 1-percent aqueous solution of potassium permanganate, and gently warmed over alcohol flame for 10 minutes. Washed in water.
5. Smear covered with 2-percent aqueous solution of gentian violet for 10 minutes (not warmed). Washed in water.
6. Slide dried in air, inspected with oil-immersion lens.—

NAGLER, H. J., Passed Assistant Surgeon U.S.P.H.S.R.

NEUROLOGIC COMPLICATIONS FOLLOWING DENGUE

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An analysis of the clinical syndrome of dengue fever as seen in the South Pacific was recently made by Stewart.¹ His review of 300 patients so affected is an excellent contribution.

Very little is mentioned in the literature about the neurologic manifestations during the acute phase of dengue fever. Observers have noted that patients manifest apathy, sleeplessness, drowsiness, restlessness, paresthesias, mental depression and occasionally evidence of meningeal irritation during the acute phase of the illness, but nowhere is there any mention of any delayed neurologic disturbances.

During a recent campaign in the Central Pacific, 1,488 cases of dengue fever were studied and treated at this hospital within a period of 40 days. About 1 month after the crest of the epidemic had passed, several patients with varied neurologic disturbances presented themselves. In the beginning these neurologic abnormalities were interpreted as being due to some obscure cause. Further and closer investigation, however, showed that the onset of these complaints followed mostly within a fortnight of dengue fever, and were not related to any other illness, trauma, toxic factors or dietary deficiency.

It is our purpose to present a series of neurologic case studies to illustrate that, at least in the element of time, there are neurologic disturbances which bear a direct relationship to dengue.

This report includes 13 patients with neurologic complications following dengue fever. These include 2 patients with peripheral (Bell's) facial palsy, 2 with palatine palsy, 2 with long thoracic nerve palsy, 2 with ulnar nerve palsy, 4 with peroneal nerve palsy, and 1 with sciatic neuritis.

CASE REPORTS

*Case 1 (Bell's palsy).—*The patient, age 19 years, complained of weakness of the right side of the face, which became progressively worse for 2 days fol-

¹ STEWART, H.: Dengue; analysis of clinical syndrome at South Pacific advance base. U. S. Nav. M. Bull. 42: 1233-1240, June 1944.

lowing his discharge from the hospital after recovering from dengue in August 1944. The disease had run a typical course for 1 week. Five months previously, following an attack of catarrhal fever, acute, he had developed a palsy of the left side of the face with inability to close the left eye, to whistle, or to take liquid food without spilling. Recovery was gradual and complete after 8 weeks.

Neurologic examination showed a typical Bell's palsy on the right side with inability to close the right eye, flattening of the right side of the face, inability to smile or whistle on the right, and no voluntary movement of the right side of the forehead. There was no sensory disturbance on the affected side. Taste was intact and corneal reflexes were not disturbed. Thiamine chloride was administered and recovery of function of the right side of the face was complete in 6 weeks.

Case 2 (Bell's palsy).—For 1 week during the latter part of August, this patient, age 26 years, had dengue. Two weeks after subsidence of the dengue fever, partial immobility of the entire right side of the face developed and progressed to complete paralysis within 2 days. The patient had had a tetanus toxoid injection the previous May.

Neurologic examination showed a complete facial paralysis, with inability to close the right eye, the eyeball rolling up and backward while attempting to do so, and with inability to whistle or to draw up the right side of the face or forehead. There was no sensory abnormality. Taste was intact, and corneal reflexes were present.

The patient was given thiamine chloride, instructed to carry out facial exercises and also received massage and electrical stimulation. Five weeks after discharge the only remaining symptom was some inability to close the right eye.

Case 3 (Palatine palsy).—A 21-year-old Marine complained of regurgitation of fluids through the nose. He had had a tetanus toxoid injection in February 1944, and during the last week of August and early September had had dengue. The neurologic symptoms were first noticed during the first week of October when he began to speak with a nasal twang. About a week later he began to have difficulty in swallowing and fluids regurgitated through the right nostril.

There was a nasal quality to this patient's speech and the right side of the palate failed to elevate and was drawn to the left when he said "ah." He was unable to pronounce the letters "k" or "e."

After 1 month's treatment with thiamine chloride, a check-up failed to show any change in these findings.

Case 4 (Palatine palsy).—The symptoms of hoarseness and sore throat in a 27-year-old patient who had dengue fever from 3 September to 8 September 1944, were first noted on the latter date. He had had a tetanus toxoid injection in May. A smear and culture from the throat secretions were negative for diphtheria organisms; nevertheless the patient was given diphtheria antitoxin. Examination at that time showed a weakness of the left side of the palate. Neurologic examination showed right palatine weakness, and treatment with thiamine chloride was instituted. After 3 months there was some improvement, but weakness of the palate was still present.

Case 5 (Long thoracic nerve palsy).—This 20-year-old patient complained of weakness of the right arm and shoulder which progressed so that he was unable to raise the arm above shoulder level. His past history included a recur-

rent attack of malaria in June 1944, a tetanus toxoid injection in October, and an attack of dengue fever in August for 1 week. The neurologic symptoms had their onset 2 weeks after the patient's recovery from dengue. Neurologic examination showed a typical "winged" scapula on the right side when the arms were held outstretched forward. The right arm could not be raised above the horizontal. A follow-up note 2 months later reported no change since his discharge.

Case 6 (Long thoracic nerve palsy).—This 21-year-old patient had had several attacks of malaria. In May 1944 he received tetanus toxoid. In the early part of August he had an attack of dengue which lasted approximately 1 week. On 7 September, during an attack of malaria, he experienced pain in the right shoulder and then progressive weakness of this shoulder. Neurologic examination showed a "winged" scapula on the right side which became prominent when both arms were stretched forward. Repeated check-ups after 3 months showed no change.

Case 7 (Ulnar nerve palsy, bilateral).—A Marine, age 24 years, complained of weakness of the grip in both hands. He had had tetanus toxoid in May 1944. In mid-August he had an attack of dengue which lasted 10 days. The neurologic symptoms started after the fever had subsided. The patient first noticed bilateral weakness of the grip and then numbness over the ulnar nerve distribution of both hands. He was first seen in consultation 3 months after the onset of the neurologic symptoms. Neurologic examination showed a hyperesthesia over the ulnar nerve distribution of both hands. There was no atrophy but definite limitation in the action of the opponens muscles and weakness of the grip on both sides. No follow-up was obtained on this patient.

Case 8 (Ulnar nerve palsy).—The patient, age 31 years, complained of weakness of the grip in the left hand. He had received tetanus toxoid in May 1944. In mid-September he had an attack of dengue which lasted 1 week. A week after the subsidence of the dengue fever weakness and numbness of the left hand developed. The weakness progressed so that he could hardly hold anything in this hand. Neurologic examination showed a hyperesthesia over the ulnar distribution of the left hand, weakness in adduction of the thumb, and inability to oppose the thumb and little finger. Generous doses of thiamine chloride were administered and after 2 weeks motor function of the left hand was greatly improved, although the hyperesthesia remained.

Case 9 (Peroneal nerve palsy).—The complaint of this 23-year-old Marine was dragging of the right foot. He had had repeated attacks of malaria. He received tetanus toxoid in May 1944. During the last week of August he had dengue, and approximately 5 weeks later he noticed weakness and dragging of the right foot. To avoid catching the toe he walked with a steppage gait. Examination showed weakness on dorsiflexion of the right foot. The patient was given thiamine chloride and was subsequently evacuated.

Case 10 (Peroneal nerve palsy).—This patient, age 25, had malaria in February and June 1944. In April he received tetanus toxoid. In the last week of August he had dengue fever and 2 weeks later he experienced pain and weakness in the right foot. The weakness progressed so that soon the foot began to drag. Examination showed a foot drop on the right with weakness of the dorsiflexors, and hyperesthesia over the dorsum of the right foot, with a tongue-like projection of diminution to pain extending halfway up the anterior tibial area. No improvement followed treatment with fairly large doses of thiamine chloride, and the patient was evacuated.

Case 11 (Peroneal nerve palsy).—Two weeks following an attack of dengue in August 1944 which lasted 8 days, this patient developed a dragging of the right foot and instability when walking over rough ground. He too had received tetanus toxoid in May. Examination showed a foot drop on the right and weakness upon dorsiflexion and inversion. Walking was difficult and he had a slapping gait. The patient was evacuated shortly thereafter and thiamine chloride therapy was recommended.

Case 12 (Peroneal nerve palsy).—Three weeks following an attack of dengue fever in October 1944, a 23-year-old Marine experienced numbness in the right foot and weakness while walking. He had had tetanus toxoid the previous May. Neurologic examination showed hypalgesia over the right anterior tibial area from about 8 cm. below the right knee down to and including the dorsum of the foot and first three toes. There was marked weakness of dorsiflexion of the right foot which made walking difficult and awkward. Thiamine chloride therapy was administered, but no improvement was noted at the end of 5 weeks.

Case 13 (Neuritis, sciatic).—The patient, age 28 years, complained of pain down the back of the leg. His past history included a tetanus toxoid injection in May 1944; there was no history of trauma. During the latter part of August he had an attack of dengue which lasted 9 days. Three or four days after the dengue fever subsided, he experienced a sharp pain, beginning over the right buttock and radiating down the posterior aspect of the leg to the ankle. The pain was aggravated by bending or stooping but not upon coughing. Neurologic examination showed only hypalgesia over the right lower leg and foot. Thiamine chloride was administered; after 3 weeks there was no improvement.

COMMENT

Dengue fever is a "one week" disease and fortunately has a very low mortality. The disease is due to a filtrable virus transmitted by the mosquito *Aedes aegypti*. As in other virus diseases, the dengue fever virus may have a latent affinity for the nervous system. Stitt has suggested that there are several strains of the dengue fever virus; the immunity being variable and individual. Possibly one of these strains may be neurotropic for the peripheral nervous system.

It can only be pointed out here that the neurologic disturbances in the cases reported followed dengue fever within a short interval, ranging from a few days to a month. In no case was there a history of trauma or other recent illness, except in case 6 in which the onset of the neurologic symptoms coincided with an attack of malaria.

It may be argued that vitamin deficiency is the underlying cause for these abnormal neurologic manifestations. Although it is true that the men had previously been through a rugged period of combat on C rations, nevertheless during their illness with dengue fever, most of the patients were receiving multivitamins and had a varied and adequate diet. In some cases the men had been off ships only a few weeks, had not been in combat, and had

had an abundance of fresh food. The length of duty overseas varied from 4 to 32 months.

All of the men had received tetanus toxoid from 4 months to 1 year prior to their dengue fever. Several had received recent typhoid inoculations.

The neurologic complications recorded here were seen in patients who were sent for consultation because of their neurologic symptoms. Undoubtedly other patients with neurologic symptoms following dengue fever went unrecognized.



AMEBIASIS CUTIS

Amebic infection of the genito-anal region varies a great deal in its gross appearance. In some cases it manifests itself merely as minute ulcers of the already existing papillomas, fistulas, and so forth. In others it may be in the form of extensive ulceration or even gangrene. In the first group diagnosis is difficult and only made on careful histologic examination. In the second group the appearance may be alarming and diagnosis has to be made from ulcerative granuloma of the pudenda (granuloma venereum), condylomata, and tuberculous condition. A previous history of dysentery may help but dysentery is so common that little reliance can be placed on this, and cases have been reported showing no previous history of dysentery.

Amebiasis cutis has been noted to be an extremely painful condition. Pain is not a prevailing feature in the granulomas. Nearly all the reported cases have arisen secondarily to a previously present lesion of the skin; fissures-in-ano, hemorrhoids, papillomas, condylomas and carcinomatous conditions are reported. The color of the lesion, a mixture of pinks and yellows reminiscent of the amebic colon, helps in making a decision.

Colonies of amebas deep down in the dermis away from the surface ulceration may be demonstrated. It is suggested that a positive diagnosis can more easily be arrived at by withdrawing serum from deep in the tissues around the ulcer margins, as in searching for *Leishmania tropica* in oriental sore and spirochetes in a primary syphilitic lesion.

Amebiasis cutis of the perineum occurred wherever amebiasis is particularly common. It is thought that the rise in the incidence of amebiasis may be accompanied by an increase in its local manifestations. There is a grave risk that such cases may be diagnosed by the unwary as venereal in origin.—McCONAGHEY, R. M. S.: Amebiasis of the anus and perineum. *Indian M. Gaz.* 80: 79-81, February 1945.

CENTRAL MACULAR CHORIORETINITIS IN NAVAL PERSONNEL

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This study comprises a group of 31 young adult males having central macular lesions, who were observed at the U. S. Naval Hospital, Oakland, California, from July 1942 to November 1943.

These patients were selected from a much larger number having chorioretinitis, showing in one or both eyes choroid and retinal lesions of the usual type commonly associated with focal infections or tuberculosis.

The thirty-one patients represent 37 diseased eyes, in 6 patients the condition being bilateral. In addition to this series of cases, one of us has seen from 15 to 20 patients with similar lesions while on duty at the U. S. Naval Hospital, Mare Island, California, during the early part of 1942.

The condition is associated with a rather characteristic symptom-complex in the majority of patients. The lesion is always limited to the central macular area of the retina, with involvement of the fovea and perifoveal region. The following case report serves to illustrate the usual type of case. There may be slight variation in the extent of the involvement of the retina and choroid and in the resulting symptoms.

Case report.—An 18-year-old seaman, second class, was admitted to the hospital complaining of blurred vision in the right eye. The family history was noncontributory and there was no previous history of focal infection. Venereal disease was denied.

The patient was on duty aboard ship in the South Pacific area when he first noticed blurring of vision. The onset of symptoms was quite rapid over a period of a few hours, and was associated with severe right-sided headache and eye ache. He complained of red vision for a day or two, together with severe photophobia. The headache subsided to some extent, but was aggravated by exposure to bright light and heat.

On admission to the hospital, three weeks after onset, examination revealed the following: Visual acuity, right eye, 2/20; left eye, 20/20. Corneal sensation was normal. Moderate tenderness was present over the right supratrochlear nerve. Pupillary reactions were normal. Ocular media were clear. The

fovea of the right eye was the site of a small atrophic spot surrounded by fine, granular pigment. The appearance was that of a small hole or cyst in the fovea, not penetrating the entire thickness of the retina. It was less than $\frac{1}{2}$ disk in diameter, slightly larger than the normal fovea. Optic disks and vessels appeared normal. On the side corresponding to the lesion there was a central scotoma (target 2/1,000, white) which extended 10 degrees from fixation in all meridians. A centrocecal scotoma connected the aforementioned scotoma with the blind spot. With the exception of the central 2 degrees to 3 degrees, which was absolute, the scotoma was relative in type.

Laboratory examinations.—These included urinalysis, complete blood count, platelet count, bleeding and coagulation time; all were normal. An Addis cell count of concentrated urine showed normal findings. Kahn test was negative. Tuberculin tests, in the three usual dilutions, were negative. Stool examinations for ova and parasites were reported negative. Roentgenograms of the chest showed normal findings. Cold pressor tests gave results within normal limits.

Hospital course.—This was without incident until 6 weeks after admission to the hospital. On this date, at sick call, the patient complained of "something" in his unaffected left eye. Examination showed a diffusely injected eyeball. No foreign body was found. Corneal sensation was normal. Slit lamp examination of the anterior segment was normal and visual acuity of the right eye was 2/20; the left eye 20/20. A drop of 4-percent cocaine was instilled into the left eye and the patient's discomfort was relieved; the "foreign body" sensation did not return that day. The same day, about noon, while outdoors the patient noticed sudden blurring of vision in his left eye, accompanied by headache, eye pain on the same side, and photophobia. On returning to the ward everything appeared red. A small blurred spot was present in the center of his vision. Examination next morning showed a vision, right eye 2/20 and left eye 6/20. Externally the left eye appeared normal and ocular media were clear. The retinal veins appeared dilated, with moderate uniform constriction of the arteries, more pronounced in the small arterioles leading to the macula.

A small, round, punched-out area of yellowish-gray infiltration was seen at the edge of the fovea; the lesion was approximately twice the size of the fovea. There was no surrounding edema. The lesion appeared flat when viewed through the binocular ophthalmoscope. The left optic disk appeared whiter than that on the opposite side. A small relative scotoma, 5 degrees in diameter, was present (2/1,000, white target). All laboratory examinations were repeated, with negative findings.

Treatment.—Amyl nitrite was administered by inhalation, without any appreciable effect on the caliber of the retinal blood vessels or any symptomatic improvement. Over a period of from 3 to 4 days there was a change in color of the lesion from yellowish-gray to dark red, and in approximately 2 weeks a small hole, with bright red reflex underlying it, was seen at the edge of the fovea. The vessels and disk appeared normal. The headache, photophobia, and pain in and about the eye persisted in varying degrees during the remainder of his hospitalization. Vision in his left eye gradually improved to 12/20 over a period of 6 weeks, whereas that in the right eye (2/20) remained without change. A small relative scotoma was present in the left eye.

On the patient's discharge from the hospital 3 months after onset of symptoms in the left eye, there was no further change in either eye, except for slight diffuse pigment accumulation around the edges of the left-sided lesion.

COMMENT

The symptoms and course in this case are characteristic of the majority of the cases observed. In some of the patients there were few or no symptoms aside from the blurred vision. Various degrees of hole formation and pigmentation were observed. The size of the lesion varied from that barely perceptible to the eye, to a size one-sixth of a disk diameter. Vascular changes were noted only in the patient reported above. Two other patients were observed during the onset of the disease and the retinal vessels appeared normal. As a rule the field changes were proportionately greater than expected from the size of the lesion. In many patients the central fields showed large relative and absolute scotomas of the centrocecal type, characteristic of retrobulbar neuritis.

ANIMAL EXPERIMENTATION

Animal experimentation consisted of inoculation of human spinal fluid from affected persons into the eye, brain, and peritoneal cavity of guinea pigs. Control experiments were made, using spinal fluid from unaffected persons.

Technic of inoculation.—Inoculation of the brain followed trephining of the skull through the vertex, with the introduction of $\frac{1}{2}$ cc. of spinal fluid by means of a hypodermic needle attached to a tuberculin syringe.

In the eye inoculations, the spinal fluid was introduced well back of the ciliary body by a fine hypodermic needle, in amounts varying from 1 to 3 minims.

In intraperitoneal inoculations, $\frac{1}{2}$ cc. of the spinal fluid was injected through the abdominal wall.

Following the inoculations all animals were examined daily until subsidence of the acute signs and symptoms. Slit lamp examination of the anterior segments was done until these showed no further changes. Ophthalmoscopic examinations were done frequently.

Guinea pig No. 1.—One-half cubic centimeter of spinal fluid from one of the patients with chorioretinitis was injected intraperitoneally into this pig on 20 July 1943. Again on 5 August 3 minims of the spinal fluid withdrawn from this same patient was injected into the right eye of this guinea pig.

On 7 August the guinea pig seemed normal except for the right eye. There was a purulent exudate in the anterior chamber and on the surface of the lens. Many vitreous opacities were present. On 9 August the right cornea was semi-opaque and the vitreous appeared milky. The pupil was dilated with atropine.

On 11 August the vitreous was completely filled with milky

exudate and an iridocyclitis of severe degree was present. On 16 August the animal did not appear very active and had a tendency to drag its hind legs. By 30 August it had recovered the use of its legs but the right eye was blind.

Guinea pig No. 2.—On 5 August guinea pig No. 2 received $\frac{1}{2}$ cc. of spinal fluid from the same patient. The material was injected into the brain. No symptoms developed in this pig during the 3 months' observation.

Guinea pig No. 3.—On 5 August this pig received intraperitoneally 1 cc. of spinal fluid from the same patient. No systemic symptoms were observed up to 1 September. On that date, vitreous fluid from an affected animal was introduced into the left eye. The next day a beginning iridocyclitis was noted. This became progressively worse, the cornea ulcerated, and there was partial sloughing of the corneal tissue.

Guinea pig No. 4.—On 9 August spinal fluid from another patient with chorioretinitis was introduced into the brain and left eye. The following day the left eye showed vitreous opacities, a small pupil, dust-like opacities on the anterior lens capsule, and exudates on the surface of the iris. By 12 August the vitreous was filled with milky-colored exudates, and there was severe iridocyclitis. On 14 August the cornea appeared semi-opaque. By 20 August the eye condition was inactive and this prevailed up to 10 October, at which time the left pupil was seen to be irregular and there was a cloudy lens and vitreous.

Guinea pig No. 5 (control animal).—On 9 August brain and eye inoculations with spinal fluid from a patient with a *traumatic* macular lesion were done. No eye or systemic signs or symptoms developed during 2 months of observation.

Guinea pig No. 6.—On 9 August brain and eye inoculations with spinal fluid from a patient with iridocyclitis following trauma were done. No eye or general symptoms were noted during the 2 months' period of observation.

Guinea pig No. 7 (control).—On 9 August the brain of this pig was inoculated with spinal fluid from a patient with functional amblyopia. No symptoms had developed in 1 week's time. On 16 August approximately one minim of fluid taken from a herpes febrilis lesion of the lip, diluted with 3 drops of normal saline, was injected into the right eye. One minim was also injected into the peritoneal cavity. The next day a violent iridocyclitis of the eye was observed. By 30 August no systemic symptoms had appeared and the eye lesion was inactive, with evidence of a healed iridocyclitis.

Guinea pig No. 8.—Spinal fluid from a patient with chorioreti-

nititis was injected into the brain and left eye on 21 August. No eye or general symptoms had developed up to 8 October.

Guinea pig No. 9 (control).—On 21 August spinal fluid from a patient with a sympathetic ophthalmitis was injected into the left eye. No eye or general symptoms had developed by 8 October.

DISCUSSION OF ANIMAL EXPERIMENTS

Systemic symptoms and signs developed in one animal only (guinea pig No. 1) following intraperitoneal inoculation. Within 4 weeks this animal seemed quiet and the hind legs appeared partially paralyzed. The pig had considerable difficulty in getting about the cage. This was 1 week following the eye inoculation. Two weeks later this pig regained the use of its legs, and seemed normal except for the right eye which was blind.

In three animals (guinea pigs Nos. 1, 3, and 4) characteristic eye lesions were observed following inoculation of the spinal fluid from patients with the chorioretinitis. The affected eye was the site of an acute iridocyclitis appearing rapidly within from 24 to 48 hours following inoculation. A severe anterior segment involvement was seen some time during this period, the pupil became small and irregular, the lens was covered with dust-like opacities or frank exudates, and the vitreous humor was cloudy. Posterior synechiae developed in these three cases. All the signs of acute inflammation subsided within from 2 to 3 weeks, but the posterior adhesions of the iris remained, lens opacities developed and the vitreous remained cloudy. In one animal the cornea became ulcerated and partially sloughed, leaving the iris exposed.

Microscopic sections of the eyes of these three guinea pigs showed severe round-cell infiltration of the iris and ciliary body, with focal necrosis and atrophy indicative of a severe iridocyclitis. In the control animals no general or eye symptoms were observed following the inoculation of spinal fluid taken from patients with eye conditions unrelated to the chorioretinitis described in this paper (guinea pigs Nos. 5, 6, 7, and 9).

The lesion that developed in guinea pig No. 7 following inoculation of the herpetic material seemed identical in appearance to the iridocyclitis observed in guinea pigs Nos. 1, 3, and 4.

Etiologic factors.—There are a number of possible etiologic factors involved in this type of chorioretinitis, none of which fits the facts in all cases. In general it can be said that the condition is almost entirely limited to young adult males. The average age was found to be 23.7 years. Of all cases of chorioretinitis, including those due to focal infections and tuberculosis, the average age at onset was 26.7 years.

Exposure to bright sunlight and glare from sand or water was a factor common to many of these patients.

Focal infection did not play any real part in these patients; of the 31 described, only 6 showed obvious foci in tonsils, teeth, sinuses, or genito-urinary tract. There were only 2 positive tuberculin tests in this series.

The only significant finding in the blood count was an occasional slight eosinophilia. This was not unusual, however, in patients arriving from the South Pacific.

The spinal fluid data in three patients were the only significant findings in the various laboratory examinations which were performed. In these cases the colloidal gold curve showed an elevation in the middle portion, similar to the meningitis type of curve.

The symptomatology in many patients was suggestive of a deep-seated process with involvement of several of the cranial nerves. Headache, eye ache, and sensation of "something in the eye" without an obvious lesion, suggested referred pain along the distribution of the ophthalmic division of the trigeminal nerve. The lesion in most cases seemed to be limited to the ganglion cell or nerve fiber layer of the retina, indicating involvement of the optic nerve.

It has been suggested that this condition had its origin in vascular changes due to the stress and strain of war on these patients. Peripheral vascular spasm, the result of constitutional factors, an anxiety state, or a labile vasomotor system have been given as possible etiologic agents. These factors may have been operative in some but not all of the patients comprising this series.

Gifford and Marquardt¹ have described a central angiospastic retinopathy in young adults with some points of similarity to the condition described here.

In their cases a central macular edema of recurrent type was associated with transient visual changes best explained on the basis of angiospasm. In these patients, however, there was evidence of vasomotor lability with temperature changes in the extremities. Pigment accumulation and the central atrophic lesion were not observed in their patients.

From the experimental side the evidence consisted of the occurrence of acute iridocyclitis set up by injection of spinal fluid from the affected patients into the guinea pigs' eyes. Although this is suggestive of an infectious cause, too few experiments have been done to allow definite conclusions.

¹ GIFFORD, S. R., and MARQUARDT, G.: Central angiospastic retinopathy. *Arch. Ophth.* 21: 211-228, February 1939.

REPORT OF A DIPHTHERIA EPIDEMIC

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By the standards commonly employed to define "epidemic," 15 cases of diphtheria would not be worthy of report. However when we realize that only 20 cases of diphtheria were reported in the entire personnel of the U. S. Navy in 1941, this number occurring in a single command in 1 month assumes, by comparison, epidemic proportions.

This outbreak occurred in a metropolitan area outside the United States, and was confined to American military personnel. There had been no increase in the incidence of diphtheria in the large civilian populace; not a case of diphtheria in adults had been reported during the preceding 6 months.

Secretions from the throats and noses of the staff and of the patients in the hospital were cultured. Two carriers were discovered, but on careful check it was found that neither of them had been in even remote contact with any of the men who developed the disease. Common dining places were investigated; two of the patients, however, had come from units outside of the city and had not been on liberty for 2 weeks. One patient was a member of our own staff, and he had not been at a place of public entertainment for a period longer than the incubation limit. All of the usual channels of spread were studied, but it was impossible to find a common source.

It was then thought that the cause of the epidemic might possibly be a matter of relative immunity. In many countries in Europe no attempt is made to render children immune to diphtheria by systematic prophylactic injections. Therefore a moderate number of cases are constantly present among children in urban communities. This suggests the possibility that many adults may have repeated attacks of subclinical diphtheria, and while having relative immunity themselves, are able to pass the disease on to persons more susceptible. In the United States the systematic protection of children and the careful quarantine of all cases have doubtless rendered the populace more susceptible, because of little contact with the causative organism, than are people who have had little or no artificial protection.

To support this theoretical point of view, attention is invited to a case seen here. In a civilian worker, routine culture presented a positive finding. Her Schick test was negative. After 2 weeks, the nasal and throat secretions became negative for diphtheria organisms. It was found that she had had a mild sore throat for 2 days prior to her reporting for culture.

This was apparently not a case of a chronic carrier, but of a person who had had a very mild attack of diphtheria. Her throat had been sore but her indisposition had not been sufficient to keep her away from her work. She had recovered without treatment and her nose and throat secretions had become spontaneously negative for diphtheria organisms.

Statistics show that less than 20 percent of Americans between the ages of 20 and 30 show susceptibility by Schick test. Of those tested in this command, 39, or 30 percent, were found strongly positive. Of these, 9, or 23 percent, gave histories of having received diphtheria prophylaxis while in grammar or high school. Of the 15 patients who were diagnosed as having clinical diphtheria, 8 had had prophylaxis. The average age of all tested was 23 years.

This brings us to two conclusions: (1) In the group tested there are more Schick-positive persons between the ages of 20 and 30 years than statistics would indicate; and (2) immunity is not of the apparent permanence which has been ascribed to it.¹

If the foregoing points can be given credence, it would seem reasonable to suggest that units whose duties will require them to be for any length of time in metropolitan areas in foreign countries be given Schick tests to determine their susceptibility to diphtheria.

Case report.—A 50-year-old white man, who had had a chronic dermatitis for 3 months, complained one morning of severe sore throat, pains in his joints and back, and difficulty in breathing. Past and family histories were not important; the systems were normal except for a residual pigmentation of the skin from his old rash, and for the throat involvement.

On examination his left tonsil was found to be enlarged and reddened. The tissue of the soft palate was edematous but there was no membrane. His neck was swollen on the left side, the swelling extending from the angle of the jaw to the left clavicle. A diagnosis was made of incipient peritonsillar abscess and cellulitis of the neck.

Hot packs were applied to the neck and he was placed on sulfathiazole and abundant fluids. On the following day an incision was made into the peritonsillar area, but no pus was obtained. Twenty thousand units of the calcium salt of penicillin were then given intramuscularly every 3 hours for five doses daily. This therapy was continued until a total of 600,000 units had been

¹ DUNHAM, G. C.: *Military Preventive Medicine*. 3d edition. Military Service Publishing Company, Harrisburg, Pa. 1940. p. 82.

administered. On the fifth day, examination showed a gray friable membrane covering the left tonsil and a portion of the uvula. The swelling in the neck was unaltered, and the patient was unimproved. Smear and culture taken at that time showed a profuse growth of *Corynebacterium diphtheriae*.

The sulfathiazole and penicillin were discontinued and 30,000 units of diphtheria antitoxin were administered intramuscularly. Fluids were kept up to 3,500 cc. daily.

His condition improved almost immediately; the temperature dropped from 102° F. to 99° F.; the pulse rate came down to 80 from 100+, and the sore throat subsided. In 2 days the swelling in the neck had almost disappeared, but he then developed a "nasal" quality to his speech and complained of inability to swallow. His pulse became slightly irregular and he was restless. An electrocardiogram made on the eighth day of his new illness showed early myocardial damage. He was kept at bed rest and was treated supportively. On the thirteenth day an electrocardiogram showed evidences of increased myocardial damage.

The patient's symptoms of difficulty in swallowing and his cardiac irregularity continued, the latter developing into a distant gallop rhythm with a blowing systolic murmur. There were no noticeable changes for the next 10 days; the irregularity of the heart rate and the murmur subsided, and there was improvement in his ability to speak and swallow. His blood pressure remained at 126/80, pulse around 80, and temperature 98.6° Fahrenheit. However on the forty-third morning of his illness he suffered a sudden cardiac depression and died.

The correct diagnosis had been missed in this case for 5 days. However this patient was the first of the series of 15 to be seen, he was 50 years of age, and the early swelling of the neck and the absence of a membrane in the pharynx for 5 days were atypical for diphtheria.

Both sulfathiazole and penicillin were ineffective in the treatment of this case of diphtheria.

CONCLUSIONS

1. In countries where prophylaxis is not practiced against diphtheria, adults may have subclinical attacks, and while being relatively immune, may spread the disease to more susceptible persons.

2. A higher percentage of persons between the ages of 20 and 30 years in the group tested were susceptible to diphtheria than would be indicated by current statistics.

3. Immunity conferred by artificial means is variable in its duration and would seem shorter than commonly presumed.

4. Prophylaxis might be necessary in military groups under certain conditions.

TREATMENT OF GONORRHEA WITH PENICILLIN IN A NAVAL DISPENSARY

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The successful treatment of gonorrhea with penicillin has been repeatedly demonstrated (1) (2) (3) (4). These reports, however, have been on hospitalized patients with a variation in the number of sick days lost. The average hospital stay of patients with uncomplicated gonorrhea is estimated to be about 7 or 8 days (5).

The personnel at this activity is stationed for short periods to undergo intensive training in special schools. Loss of time results in interrupted and delayed training schedules, which diminishes the efficiency of the schools and prolongs the time allotted each student.

This report concerns 95 successive patients with gonorrhea and 5 with acute nonspecific urethritis, treated with penicillin. The procedure included 21 hours in the dispensary's sickbay for penicillin injections, followed by a period of observation during which the patients were ambulatory, attended schools and were on full duty status.

The 21-hour period of retention in the sickbay resulted in no recorded sick days. The advantages of the procedure were quickly recognized by the men, who responded by reporting promptly at the first sign of a urethral discharge. The merits of early diagnosis and prompt treatment from a public health standpoint are obvious.

When a diagnosis of gonorrhea was established by stained smear the patient was admitted to the ward and treatment consisting of 140,000 Oxford units of penicillin, in 7 doses of 20,000 units each, given intramuscularly every 3 hours, was instituted. This dosage was selected as an arbitrary amount, although good results have been obtained with less (6). On completion of the injections, the patient was returned to full duty but restricted to the station.

Follow-up studies included daily examination for urethral discharge and pyuria by means of the two-glass test and microscopic

examination. On the sixth day, if no clinical or laboratory evidence of infection remained, wet smears of the prostatic fluid were examined microscopically. The indications for removal of restrictions and final release of the patient were (1) no urethral discharge, (2) a clear two-glass urine test, and (3) a maximum of 20 leukocytes per high power field in the prostatic fluid. The patient was then checked at 7-day intervals for 2 weeks.

No culture of the urethral discharge or of the prostatic fluid was made because of inadequate laboratory facilities. Bacteriologic studies would have aided in the analysis of the failures and the nonspecific group.

When the urethral discharge persisted at the end of 6 days, with or without gonococci, or if a severe pyuria was present, no prostatic manipulation was attempted and the patient was readmitted for a second course of penicillin.

The blood Kahn test was performed on all patients on admission and repeated 1 month later. Elevation of temperature during the period of administration of the drug was viewed as a Herxheimer-like reaction, indicating a possible syphilitic infection acquired at the same or at a recent exposure (7) (8). One patient developed a positive Kahn reaction after the urethral infection had been treated and cured. Re-examination showed several moist papules on the glans penis with a regional and general adenopathy. Dark-field studies were negative, but the Kahn test remained strongly positive, and antiluetic therapy was instituted.

One hundred successive patients were treated. Ninety-five had acute gonorrhea and 5 were diagnosed as having nonspecific urethritis. Eighty-nine of the patients with gonorrhea were clinically cured, and of these, 81 responded to 1 course of penicillin therapy. Of the remaining 8 cured patients, 7 responded to a second course. It was necessary to give 1 patient 4 courses before clinical cure resulted. Including the re-treated patients, 93.6 percent achieved cure. Six patients with gonorrhea and 1 with nonspecific urethritis failed to respond to penicillin therapy. These 7 patients were classified as failures.

CASE REPORTS OF FAILURES

Case 1.—A Negro steward's mate, first class, age 19, had had numerous previous attacks of gonorrhea. He received 100,000 units of penicillin in a Naval hospital 4 weeks prior to the present new infection and was discharged as cured. After 2 courses of penicillin failed to clear the urethral discharge, daily instillation of $\frac{1}{4}$ -percent protargol, with sulfathiazole orally, finally produced a cure in 1 month. This patient may have developed penicillin fastness after having responded satisfactorily 1 month previously.

Case 2.—A gunner's mate, third class, age 31, had had numerous previous attacks of gonorrhea, the most recent having been treated 10 days before with penicillin at a Naval hospital. The urethral discharge had persisted and showed gonococci. After failing to respond to 2 further courses of penicillin, and to 2 weeks of local therapy and sulfathiazole, he was transferred to a Naval hospital.

Case 3.—A fire controlman, first class, age 20, had no previous venereal history. Gonococci were found in the urethral smear. He did not respond to 3 courses of penicillin at 6-day intervals. The discharge persisted, although no specific organisms could be found after the first course. He had never previously received penicillin. His transfer prevented further follow-up.

Cases 4, 5, and 6.—Three patients were considered failures because of complications. Two of these gave a history of repeated urethral infections and developed cystitis despite 2 courses of penicillin. One responded to ammonium mandelate and the second is still under observation. One patient developed a periurethral abscess following penicillin therapy, necessitating incision and drainage plus local therapy.

Case 7.—A seaman, first class, age 19, with no previous history of venereal disease, developed an acute nonspecific urethritis and did not respond to 2 courses of penicillin at 6-day intervals. Following failure of local therapy and sulfathiazole, he was transferred to a Naval hospital.

SUMMARY AND CONCLUSIONS

1. The treatment of gonorrhea in a Naval dispensary with penicillin is practical and efficacious.

2. A minimum time loss from duty and school of 21 hours was routine. This brief period did not interfere with the training courses. In comparison the average hospitalized patient spent from 7 to 8 days in a Naval hospital.

3. Failures and complications seem to occur mainly in those having histories of repeated gonorrheal infections.

4. No empiric dosage of penicillin should be established for treatment. Variations in amount of the drug to be administered should depend on previous history of urethral infection, response to the drug, and complications.

5. No untoward reactions were observed with the use of penicillin. One patient developed syphilis after receiving treatment for gonorrhea.

6. Ninety-five patients with gonococcal infections were treated, using 140,000 units of penicillin each, resulting in 89 cures and 6 failures (93.6 percent cures). Five cases of nonspecific urethritis were similarly treated with 1 failure.

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URETHRAL VALVES

Any male child with a persistent urinary problem which fails to respond to the usual enuresis regimen in a reasonable period of time should not be cast aside as a behavior problem but should be given the benefit of a urologic investigation. The fact that over half of the 130 cases of urethral valve reported in the literature were not diagnosed antemortem emphasizes the fact that this pathologic entity is not as widely known as it should be. In general the symptoms are diurnal as well as nocturnal and not unlike the course of events seen in the elderly male with obstructive prostatic hypertrophy. The rapidity of renal destruction depends directly upon the degree of urethral obstruction.

The valves may be destroyed either transvesically or endoscopically, using either a cutting current or a cold punch. The prognosis depends on the amount of renal damage done prior to diagnosis, the preoperative care, and the operative and post-operative management.—WHIPPLE, R. U.: Pediatric urological problem important to general practitioner. *Am. J. Surg.* 68: 297-302, June 1945.

TREATMENT OF DERMATOLOGIC CONDITIONS ABOARD A DESTROYER

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The high incidence of dermatologic problems aboard a destroyer has been reported elsewhere.¹ The types of cutaneous disorders encountered and the causative environmental factors are familiar to most destroyer medical officers. The treatment of these more common diseases should be with drugs available from the Supply Catalog rather than with highly specialized dermatologic lotions and ointments which may be difficult to obtain.

A standard list of dermatologic drugs necessary on a destroyer should include the following:

1. Whitfield's ointment— $\frac{1}{2}$ strength. In the tropics a $\frac{1}{4}$ -strength preparation is also advisable.
2. Castellani's carbol fuchsin paint. This is a most efficacious preparation against fungus infections. It is successful in a large variety of cases but especially good in resistant ones. It is not unduly harsh and is one of the few fungicidal lotions not containing salicylic acid. Sutton's method of compounding gives a satisfactory solution: To 10 cc. of a saturated alcoholic solution of basic fuchsin is added 100 cc. of a 5-percent aqueous solution of carbolic acid. This mixture is filtered and 1 gm. of boric acid is added. After 2 hours, 5 cc. of acetone is added. The mixture is permitted to stand for 2 hours and then 10 gm. of resorcin is added. It is then ready for use and may be applied once or twice a day, full strength or diluted.
3. Benzyl benzoate.
4. Five-percent salicylic acid in merthiolate.
5. Calamine lotion. This may have sulfathiazole added to it for use against acne vulgaris and other minor pyodermas.
6. Calamine lotion with 1-percent phenol and $\frac{1}{4}$ -percent menthol.
7. Crude coal tar ointment—White's formula.
8. Sulfur ointment (USP).
9. Boric acid ointment (USP).
10. Ammoniated mercury, 5-percent.
11. Gentian violet—5-percent aqueous and alcoholic solutions.
12. Potassium permanganate (for soaks).
13. Boric acid powder (for soaks).
14. Burow's solution. This must be obtained on the open market as basic aluminum acetate.
15. Tincture of iodine (mild).

¹ KLEY, E. C.: Skin diseases aboard a destroyer. U. S. Nav. M. Bull. 42: 407-408, February 1944.

16. Sulfathiazole ointment, 5-percent. This may be purchased on the open market, or prepared on the ship, preferably using a water-soluble base rather than a greasy base. The water-soluble base employed is listed in the Supply Catalog as "lubricating jelly."

17. Sulfadiazine ointment, 5-percent.

In the light of shipboard problems and medical facilities the most important conditions encountered and the best therapeutic measures to employ are as follows:

Trichophytosis and dermatophytosis.—These mycotic infections of the skin are second only to chronic sinusitis on the list of diseases encountered in any locality or environment. They are most resistant to treatment. Preventive measures must be employed or fungus infections will run rampant throughout the ship, especially in the tropics. On a destroyer, as a general prophylactic measure, the use of foot baths in the heads is not practical because of the ship's roll which spills the sodium hypochlorite solution over the deck. However the daily use of creosote on the decks of the heads, sleeping compartments and showers works out very successfully.

The following directive to the crew regarding "spic itch" will aid materially in stamping out this disease:

1. Change socks every day. Preferably wear light, white ones.
2. Do not walk barefooted on any deck, especially the sleeping compartments or heads. Wear wooden bath slippers, or any type of slipper, to and from and in the showers.
3. Cleanse feet frequently. Keep them dry.
4. Procure ashore any proprietary antiseptic dusting powder and dust on the feet, between the toes, and in the socks and shoes. Suggest several commercial foot powders. The standard Navy Foot Powder, however, admirably fills this need.
5. Report to the sickbay for treatment and bring along an extra pair of shoes so that the pharmacist's mate can fumigate your regular shoes with formaldehyde.

Obviously most of the specific treatment of fungus infections will rest with the pharmacist's mates. They must be thoroughly instructed along these lines in order to avoid overtreatment, resulting in local exacerbation and not infrequently the appearance of "id," or allergic manifestations, elsewhere on the body. A popular preparation which must be condemned vigorously is one combining equal parts of ether and alcohol, supersaturated with salicylic acid.

The three stages of dermatophytosis of the feet are treated as follows, and this classification is kept on the bulletin board in the sickbay at all times:

1. Vesicular stage (with or without infection).
 - A. Hot potassium permanganate soaks.
 - B. Hot boric acid solution soaks.
 - C. Hot Burow's solution soaks—1:20.
 - D. Mild tincture of iodine.
 (The vesicles should be opened aseptically.)
2. Moist or macerated stage.
 - A. Castellani's carbol fuchsin paint.
 - B. Five-percent salicylic acid in merthiolate.
 - C. Five-percent aqueous or alcoholic solution of gentian violet.
3. Macular or scaling stage.
 - A. Whitfield's ointment—25- or 50-percent.
 It is advisable to start with $\frac{1}{4}$ -strength and gradually work up to full strength.

Isolated forms, such as tinea cruris and tinea circinata, respond well to Whitfield's ointment, 5-percent ammoniated mercury, mild tincture of iodine, or Castellani's paint. The latter preparation has been highly successful and does not permanently stain the underclothing as does gentian violet. Controlled exposure of the area to the sun is recommended. Ointments in the tropics are uncomfortable and very messy. Wherever possible, soaks, lotions, or dusting powders seem much more satisfactory. A very soothing and effective dusting powder for the scrotal and crural areas contains the following ingredients:

	Gm. or cc.
Menthol	4 0
Salicylic acid.....	16 0
Tannic acid.....	32 0
Boric acid.....	32 0
Talc to make.....	300 0

In summation it must be emphasized not to overtreat. The disease should be treated according to the stage it is in, changing the therapy frequently as the need arises, stressing the personal hygienic factors which will prevent constant reinfection.

Miliaria rubra (heat rash, prickly heat).—The prevalence of this problem in tropical duty cannot be underestimated. The engineering divisions particularly suffer from this malady, spending many pruritic hours in the hot fire and engine rooms. For general treatment, light clothing and frequent cold showers without the use of soap are recommended. However the medical department must co-operate with the chief engineer in not recommending "hydrotherapy" too vigorously as water is a precious commodity

aboard ship. Whenever it is possible swimming parties are called away and the use of salt tablets orally is constantly stressed.

To provide local comfort, calamine lotion with 1-percent phenol and $\frac{1}{4}$ -percent menthol works admirably, as does a saturated solution of boric acid in 70-percent alcohol. A crystal of menthol in this solution helps considerably. Great relief will also be provided by an antipruritic dusting powder consisting of boric acid, menthol, zinc oxide, and purified talc. The following preparation has brought remarkable improvement in these uncomfortable people:

	Gm. or cc.
Sulfur	8|0
Zinc oxide	8|0
Spirits of camphor.....	30|0
Ether	30|0
Alcohol to make.....	280|0

Incorporate the sulfur and zinc oxide together, then mix the ether and spirits of camphor together. Add the one mixture to the other, thereby making a paste. To this paste add the alcohol.

Furunculosis and carbunculosis.—Staphylococcic infections of the skin require much consideration by the medical department. They are especially common among members of the deck division, the men who chip paint, wire-brush metal, keep the ship clean, and paint. In some instances recurrent furunculosis can be very incapacitating and result in the loss of many man-days. Sunlight, personal hygiene, and bathing after performing some unusually dirty task are general measures of great importance. The medical officer must recognize the public health features of his job and must constantly stress the basic fundamentals of good health and personal hygiene through the medium of the bulletin board, formal directives or lectures, and informal talks. The list of skin conditions that can be avoided by personal cleanliness is lengthy.

Treatment consists of hot fomentations, incision and drainage under ethyl chloride anesthesia when fluctuation appears, sulfathiazole powder or ointment locally, and in severe cases sulfathiazole orally. It should be a strict policy to do a urinalysis on all patients with furunculosis. In certain instances of recurrent staphylococcic infections of the skin staphylococcus toxoid is given.

Pediculosis pubis.—The treatment of the sailor's disease, "crabs," has now progressed past the empiric stage of local shaving, strong mercurial ointment, or hot carbolic acid preparations. With the standard Navy insecticide powder the treatment of pediculosis pubis is simplified and wonderfully effective. Two applications at weekly intervals usually suffice. In resistant cases 5-

or 10-percent ammoniated mercury "blue" ointment, 15-percent phenol in glycerin, with shaving as a last choice, may be employed.

The prevention of body lice again re-emphasizes the need for instruction of the crew. Personnel must realize the purpose of airing bedding and not try to omit it. They must remember to change "skivies" frequently. The modern warship is blessed with excellent laundry facilities and the old days of washing in a questionably clean bucket are in the distant past.

Lastly the captains of the heads are instructed to treat the head seats with creosote frequently. This is very effective, but unless the crew is cautioned not to sit on the seats until these have dried thoroughly, a few cases of burns of the gluteal regions will be encountered.

Scabies.—Scarcely any difficulty is encountered in the diagnosis of scabies, the location of which is fairly typical, and the appearance of which is highly characteristic. The benzyl benzoate treatment is extremely effective if carried out properly. To accomplish this, one of the pharmacist's mates must accompany the patient to the shower and supervise the procedure. The man is instructed to take a hot shower using soap and a brush, or a coarse cloth. While wet he applies the benzyl benzoate emulsion to the entire body omitting the face and head. This is allowed to dry and is then re-applied. He is cautioned not to remove it for 24 hours. At the end of this period he takes another hot bath with a vigorous scrubbing, followed by a complete change of clothing. Usually one or two such treatments are enough, provided the cycle or re-infection is broken.

Again personal cleanliness ranks high as a prophylactic and therapeutic measure. Bedding must be aired in the sunlight frequently and sent to the laundry at reasonable periods of time. All clothing must be kept clean. The common practice of men lying in other men's bunks must be discouraged.

Benzyl benzoate emulsion is made very simply by adding equal parts of ethyl alcohol, soft soap and benzyl benzoate. In certain resistant cases, sulfur ointment (USP) as additional therapy gives satisfactory results.

Acne vulgaris.—The large number of adolescents in the Navy accounts for the high incidence of this disease. A skin condition which is difficult to cure ashore with all the modern armamentarium will cause much trouble at sea. It is absolutely impossible to carry out the usually recommended dietary measures such as a low fat, low carbohydrate diet, on a destroyer. However, important general instructions such as drinking plenty of water, keeping the bowels open, plenty of exposure to sunlight, and the

use of a lather shaving cream rather than a brushless shaving cream with its greasy elements, can be stressed.

Locally the use of calamine lotion with added sulfathiazole powder has given promising results and may in the future supplant the commonly used lotio alba. The judicious use of 5-percent sulfathiazole in a water-soluble base may be employed. Cleansing the skin with a washcloth and castile soap twice a day is prescribed, after which the face should be rinsed with cold water.

Impetigo contagiosa.—The treatment for impetigo has been rather well standardized. However the omission of the preliminary steps of removing the crusts, followed by local cleansing with tincture of green soap and alcohol, will carry with it disappointing results. The use of sulfathiazole ointment, or ammoniated mercury ointment, in this disorder is a subject of controversy with most dermatologists. It seems to be a fairly academic discussion, however, as both work quite well. Each may be considered a reliable secondary preparation if the other fails. Considerable success, moreover, may be expected with the use of 5-percent alcoholic solution of gentian violet, although its messy appearance and staining qualities are drawbacks to its popular use. In a widespread, extending, resistant case the use of sulfathiazole orally is an excellent adjunctive treatment.



SLIDE ADHESIVE

In areas far from civilization, considerable difficulty may be experienced in obtaining adhesive substances for fastening pathologic sections to slides prior to staining. The commonly used Mayer's egg albumen is made from strictly fresh eggs, and albumen from cold-storage eggs is not satisfactory. The various starch pastes suggested as substitutes continually fail to hold the sections in place.

The following is an excellent and easily made adhesive:

	Gm. or cc.
Dried human plasma	20|00
Water	60|00
Glycerin	5|00
Thymol, 1 to 2 crystals	|

This preparation is used similarly to Mayer's egg albumen and when once mixed keeps indefinitely.—HELLMAN, L. M., Lieutenant. (MC) U.S.N.R., and SCOTT, G. E., Pharmacist's Mate. second class, U.S.N.R.



SALINE IN PROPHYLAXIS OF WOUND INFECTION

From various methods studied, the cleansing of contaminated wounds by a gentle irrigation with isotonic solution of sodium chloride is the most effective prophylaxis of wound infection. Contaminated wounds treated by this gentle irrigation healed with less evidence of infection than did control contaminated wounds subjected to no treatment other than closure at the specified time. Best results in cleansing these small wounds were obtained by irrigating them with 1,000 cc. of saline solution, with no scrubbing, utilizing the force of the stream as the washing mechanism.—PETERSON, L. W.: Prophylaxis of wound infection: studies with particular reference to soaps and irrigation. Arch. Surg. 50: 177-183, April 1945.



INTRAVENOUS ALCOHOL IN SURGICAL PATIENT

Intravenous alcohol is a potent sedative and analgesic and can be substituted for the opiates and other forms of sedation, and the sedation is not attended with depressed respiration.

It may be used in cardiac patients with relative safety because of its vasodilatory effect and minimal effect on the blood pressure and has a definite place in regional anesthesia as a supplement during the operative procedure. It has proved, moreover, its value in alcoholic patients who cannot be controlled with the usual doses of narcotics. At the present no contraindications have been found.—MOORE, D. C., and KARP, M.: Intravenous alcohol in surgical patient. Surg., Gynec. & Obst. 80: 523-525, May 1945.



CAUSE OF INGUINAL HERNIA

Besides the abdominal rings, muscles, and sac, there is the increasing intra-abdominal pressure which often causes hernias either to recur or to develop in men over forty-five. The causes of the increased intra-abdominal pressure in men over 45 usually begin with "C"—chronic cough, cardiac lesions, cirrhosis of the liver, chronic cholecystitis, colitis, cancer of the colon, clap (stricture of the urethra), chronic prostatitis, and finally excessive intake of C_2H_5OH , which causes a loss of elasticity and wasting of muscles. DODD, H.: Inguinal hernia. Lancet 1: 447, April 7, 1945.

CLINICAL NOTES

NONPENETRATING GUNSHOT WOUND OF CHEST WITH EXTENSIVE PULMONARY HEMORRHAGE

CASE REPORT WITH AUTOPSY

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Upon reviewing the literature on chest injuries, one is impressed by the lack of references to intrapulmonary injury from nonpenetrating bullet wounds of the chest. McGrath (1), in a symposium on traumatic wounds, stated that "except for the necessity of ruling out penetration of the pleura, these wounds differ little, if at all, from similar wounds elsewhere in the body." Ferguson and his associates (2), reporting on 75 battle casualties with chest wounds, failed to mention the possibility of pulmonary hemorrhage except as a result of perforation of the thorax. Elkin and Cooper (3), reviewing cases of thoracic injuries, did not describe any instances of nonpenetrating bullet wounds. Meade (4), in an extensive article on the management of war injuries of the chest, also failed to discuss pulmonary injury resulting from this type of wound.

Autopsy in the case to be reported here showed bilateral pulmonary hemorrhage of the same type and as marked as that produced by severe air blast or immersion blast injury. Zuckerman (5), and Greaves and his coworkers (6), respectively, have demonstrated experimentally the pathology of air blast and immersion blast injury of the lungs. The fundamental lesion was shown to be alveolar hemorrhage. Interesting case and autopsy reports of blast injuries of the chest have been published by O'Reilly and Gloyne (7), Hadfield and his associates (8), and others. Gage (9) and Yaguda (10) reported cases of immersion blast injuries with autopsies. Their findings agreed with the results obtained by experimental methods.

The following case is reported because of the extensive pathologic changes produced by the impact of a bullet fired at close range from a 30-caliber rifle, without penetration into the thoracic cavity. An understanding of the possible effects attending such an injury is thought to be vital to the institution of rational treatment. It was not until after continued study and observation that the diagnosis of massive pulmonary hemorrhage became apparent.

Case report.—The patient, 24 years of age, was seen within 30 minutes after he had been shot in the left side of the chest. It was believed that the wound was self-inflicted and that the muzzle of the gun had been held close to the chest wall. On admission he was in profound shock. The radial pulse could not be felt and the blood pressure was so low that it could not be determined. The head and neck were normal. The pupils were normal. The abdomen was soft and no organs were palpable. The extremities were normal.

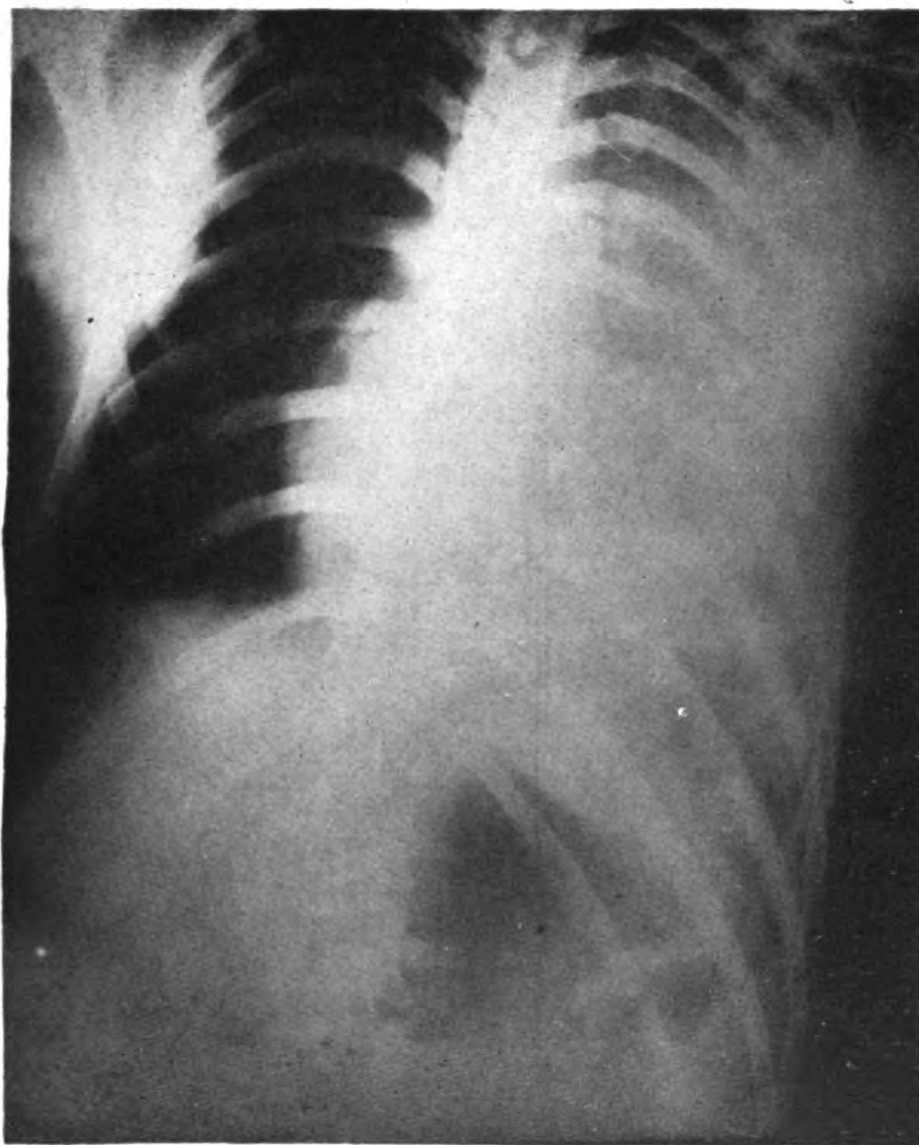
The left anterior part of the chest showed a ragged wound about 3 cm. in diameter in the region of the nipple (which had been destroyed). There were powder burns in the skin about the wound. In the left posterior axillary line, over the fourth rib, there was a smaller, round wound, about 1.5 cm. in diameter. No air could be heard passing through the wound openings. There was little external bleeding. Subcutaneous emphysema extended for several inches about the anterior bullet hole. Breath sounds could be heard in both lungs anteriorly. The percussion note was resonant. Breathing was regular and shallow. The heart sounds were distant and weak.

The patient was given three units of plasma (750 cc.), and following administration of the first unit his pulse rate was 104 beats per minute; after the second unit of plasma the blood pressure was 90/30. At that time the patient began to cough up bloody sputum. After the third bottle of plasma the blood pressure rose to 120/80. The pulse remained about 140 but was of poor quality. He was then given a transfusion of 500 cc. of citrated blood. Thoracentesis done because of the possibility of hemothorax, was negative.

Not until 3½ hours after admission did the patient begin to cough up considerable frothy blood. Moist râles could then be heard throughout the left side of the chest. An x-ray film at that time (fig. 1) showed a homogeneous density of the left mid-chest area. This density was present to a lesser degree in the left costophrenic angle. The first and second left interspaces showed areas of rounded, structureless mottling of moderate density. The right lung appeared normal.

The patient gradually became cyanotic, and cyanosis could be only partially relieved by the administration of oxygen. The lung involvement increased progressively and after 4½ hours only a small portion of the right upper lobe appeared normal. The patient continued to cough up frothy blood. After full recovery from the initial shock and without further circulatory collapse, the patient expired from respiratory failure 6 hours after admission.

Autopsy.—Postmortem examination was made 10 hours after death. A ragged hole, 3 cm. in diameter, with complete destruction of the left nipple, extended to, but not into, the left fourth rib and intercostal muscles. There was evidence of burn in the skin about the wound. A hemorrhagic excavation coursed along the region of the fourth rib, through the soft tissues overlying the thoracic cage, to the posterior axillary line where there was a hole in the skin 1.5 cm. in diameter. There was evidence of hemorrhage into the soft



Portable x-ray film of the chest taken about 3 hours after admission.

tissues overlying the left anterior portion of the thoracic cage from the second to the ninth ribs.

The left lung was completely adherent to the thoracic wall and the diaphragm, obliterating the pleural space by old, dense, firm adhesions. There was no penetration of the surface of the left or right lungs. No fluid was present in the right pleural space. Some dark blood flowed from the left and right bronchi as the lungs were removed.

The entire left lung was dark in color and the pleural surface was thickened and dull in appearance. The lung was solid to palpation and not crepitant; the cut surface showed it to be filled with dark blood. In the lower lobe there was bulging of the cut surface. Only in the apex of the upper lobe was frothy blood present. There was no normal-appearing tissue in the left lung. No hematoma or bleeding point was found. Sections from all portions of the lung sank in water.

In the anterior portion of the upper lobe of the left lung there was a thin-walled, empty cavity, 7.5 cm. in length and 4 cm. wide, the shape of an egg.

The lining was soft and smooth. There was no evidence of acute or chronic inflammation in the wall or in the surrounding tissues. No communication to the cavity was found. The left bronchial mucosa was hyperemic, but no bleeding point was present.

The middle lobe of the right lung was light in color and moderately distended. The upper portion of the upper lobe was similar in appearance. The cut surface appeared normal and sections floated on the surface of the water. The lower portion of the right upper lobe was dark in color and the cut surface oozed dark frothy blood. Sections floated chiefly below the surface of water. The lower lobe of the right lung was similar to that of the left lung, except in the extreme upper portion, where some frothy blood was present and sections floated below the surface of water. All other sections of the right lower lobe promptly sank in water. The right bronchial mucosa was also hyperemic. There was no gross evidence of changes consistent with tuberculosis. Hilar lymph nodes were few and of normal consistency.

The pericardium showed small ecchymoses on both surfaces. About 30 cc. of sanguineous fluid was present in the pericardial cavity. The heart was not distended and was grossly normal. There was evidence of hemorrhage into the tissues of the posterior mediastinum.

There was no fluid in the peritoneal cavity. The liver, spleen, gastrointestinal tract, genito-urinary system, adrenal glands and retroperitoneum were normal.

Microscopically the cyst in the upper lobe of the left lung was lined with a single layer of flat or low cuboidal cells containing little cytoplasm and large, round or ovoid, rather compact nuclei. Almost every cell contained a large amount of granular, blackish-brown pigment which often obscured the nucleus. The surrounding tissue was loose and hemorrhagic. Fresh blood in a web-like framework of fibrillar connective tissue was observed. This was thought to be a subpleural alveolar cyst of long duration. Another section of the apex of the left lung showed a moderate amount of anthracosis. The overlying pleura was slightly congested. There was marked congestion of the alveoli with evidence of hemorrhage in some areas. There was no evidence of acute or chronic inflammation.

A section from the lower lobe of the left lung showed a large focus of subpleural pulmonary hemorrhage. The base of the left lung was composed almost entirely of a blood clot with a small amount of normal-appearing striated muscle on one side. The base of the right lung showed evidence of a recent frank alveolar hemorrhage.

Several small bronchi and bronchioles were encountered. These were eroded in places, with slight evidence of acute inflammation in localized areas of the bronchial wall. There was no evidence of pneumonitis. The apex section of the lower lobe of the right lung was similar to that of the base. The right middle lobe showed considerable congestion of the alveolar blood vessels, but no evidence of inflammation or hemorrhage. In the right upper lobe there was moderate congestion of the alveolar blood vessels. One section contained areas of alveolar hemorrhage.

In the left bronchus the mucosa was sloughed off and the denuded submucosa exposed. A moderate number of chronic inflammatory cells were scattered sparsely throughout the submucosa. A section of the right bronchus was similar except that congestion of the submucosa was more pronounced. In the left hilar node a nonspecific, chronic lymphadenitis, with a moderate amount of brownish-black pigment, probably anthracotic, was present.

COMMENT

A gunshot wound in the left chest from a 30-caliber service rifle fired at close range produced bilateral pulmonary hemorrhage in a young man, without penetration of the thorax. The hemorrhage was the chief contributory cause of death. It is assumed that this was achieved by the transmission of the bullet's energy to the pulmonary structures through the thoracic wall. A chronic pleurisy with obliteration of the pleural cavity on the side of the injury was found. The influence of this finding on the clinical picture is not known. An x-ray film of the chest was similar in appearance to those obtained in cases of blast injuries of the chest reported by Thomas (11).

The pathologic changes in this case far exceeded those expected from the clinical appearance of the gunshot wound. They were of the same type and fully as extensive as those produced by immersion blast and air blast injury by relatively huge explosive charges. Hemorrhage was widespread in the left lung and in the base of the right lung, and there was evidence of some hemorrhage in the lower portion of the right upper lobe; the hemorrhage was both subpleural and alveolar in type.

An understanding of the pathologic physiology attending this injury raises the question of proper rationale in treatment. Administration of large amounts of plasma and blood might influence the extent of the pulmonary hemorrhage by increasing the blood pressure. In retrospect it is believed that only the amount of plasma or whole blood should be given which would relieve the initial shock.

SUMMARY

1. A case of nonpenetrating gunshot wound of the chest with bilateral pulmonary hemorrhage is reported.
2. The x-ray appearance of the lungs was similar to that reported in blast injuries.
3. Necropsy showed extensive subpleural and alveolar hemorrhage, which was most marked in the lower lobes of both lungs.
4. The close resemblance between this case and injury due to immersion and air blast is noted.
5. It is emphasized that in a case of this type care should be used in the administration of plasma or whole blood in order to avoid adverse effect on the pulmonary hemorrhage.

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ABDOMINAL MANIFESTATIONS OF RHEUMATIC FEVER

Association of abdominal pain and rheumatic fever has largely escaped the attention of the internist and the surgeon. Within the past few years several cases of abdominal pain were studied, the apparent cause of which was a rectus myositis which appeared as a manifestation of rheumatic activity.

The outstanding features were sudden onset of sharp pain in the right lower quadrant without radiation, no nausea or vomiting, obvious muscle spasm with tenderness over McBurney's point, and absence of rebound tenderness. When such symptoms and signs are found in a patient with a previous rheumatic history the possibility of rheumatic rectus abdominis myositis must be considered. An elevated sedimentation rate and a leukocytosis with a normal Schilling index is a further evidence of the rheumatic origin of the symptoms. A therapeutic test with salicylates will cause subsidence within 12 to 24 hours even though other manifestations of rheumatic fever persist.—REITMAN, N.: Abdominal manifestations of rheumatic fever; description of right rectus syndrome. *Ann. Int. Med.* 22: 671-678, May 1945.

CALCIFIED CYST OF THE SPLEEN

REPORT OF A CASE, WITH REVIEW OF LITERATURE

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Cysts of the spleen are rarely encountered in clinical surgery and are extremely uncommon even at the necropsy table. McClure and Altemeier (1) found only 148 reports of splenic cysts of all types in the literature up to 1941, and only 4 cysts were found in 800 splenectomies at the Mayo Clinic. Reporting a case of a calcified cyst of the spleen in 1943, Snoke (2) was able to locate only 6 similar cases. The discovery of a calcified splenic cyst on the wards of a Naval hospital and its subsequent successful treatment by surgery would seem, therefore, to be of unusual interest.

Various attempts to classify such cysts have resulted in unnecessarily complex distinctions. For practical purposes a simple division into true and false cysts, with the presence or absence of a specific lining membrane as the differentiating feature, appears to be adequate. The pathogenesis and histologic characteristics of the various types are discussed in the monograph by Fowler (3) and the more recent paper by McClure and Altemeier.

A review of the cases reported in the available literature indicates that the subjective symptoms of splenic cysts are negligible and that the patient is usually led to consult the surgeon because of the presence of a palpable mass below the left costal margin. Discomfort in the upper left quadrant of the abdomen and a dragging sensation may or may not be present. The diagnosis is made by the discovery of a palpable tumor in the upper left quadrant, which must be differentiated from cysts of the ovary and pancreas, and tumors of the left kidney, splenic flexure, stomach, or left lobe of the liver, and is confirmed by roentgenogram. The roentgenographic characteristics of splenic cysts have been described by Sweet (4) and Culver and his coworkers (5).

Snoke states that when a large annular calcification is found in the upper left abdominal quadrant by x-ray examination, the differential diagnosis lies between a solitary calcified cyst of the spleen and an aneurysm of the splenic artery. The distinguishing feature is the demonstration of a bruit in aneurysm; pulsation may or may not be evident.

The treatment of choice is splenectomy. According to Sweet such procedures as marsupialization, incision and drainage, and local excision or enucleation of these cysts are obsolete.

Case report.—An apprentice seaman, V-12, age 18 years, was first admitted to the sick list in May 1944 complaining of general malaise, muscular aching and low back pain which had been present since an attack of sore throat and cervical adenitis in March. Examination, including routine laboratory studies, yielded essentially negative results.

Within a few days he began to complain of crampy abdominal pain and epigastric distress, then of paresthesia of the fingers, pain in the knees, and a sense of discomfort in his shoulder. All these symptoms except a vague abdominal pain and malaise, gradually subsided. A gastro-intestinal x-ray series on 29 June revealed evidence of a partially calcified tumor, not attached to the stomach and lying under the left leaf of the diaphragm.

After returning to duty he continued to report to the sickbay with a variety of complaints which gradually crystallized into a main complaint of constant left upper abdominal and lower thoracic aching which was aggravated by exercise. He also stated that he had some epigastric fullness and discomfort occasionally after eating, but the relation of this complaint to his meals was indefinite. The pain bore no relation to bowel movements. He said that he never felt actually sick but always tired and under par. There had been no loss of weight.

The previous medical history was irrelevant. He had always been active in athletics and had taken part in most sports. There was no history of a definite injury, although he had received many bumps and bruises in football and basketball.

Physical examination revealed a well-nourished and well-developed white male who did not appear acutely ill. The temperature, pulse rate, and respirations were normal; the blood pressure was 140 systolic and 80 diastolic. Large axillary glands were palpable and the excursions of the left leaf of the diaphragm were limited. There was moderate tenderness to deep palpation in the left upper quadrant of the abdomen; no organs or masses were palpable and auscultation failed to reveal a bruit. There were no other pertinent findings.

The laboratory findings were as follows: The urine was normal. The hemoglobin concentration was 97 percent; the erythrocyte count was 5,110,000, and the leukocyte count 5,650, with a differential of 4 band forms, 44 segmented cells, 47 lymphocytes, 2 eosinophils, 1 basophil, and 2 monocytes. The blood nonprotein nitrogen was 32.8, the serum protein 7.51, the Kahn test negative, and the sedimentation rate of the blood was eight. Skin tests with brucellergen, Frei antigen and dipylidium were negative.

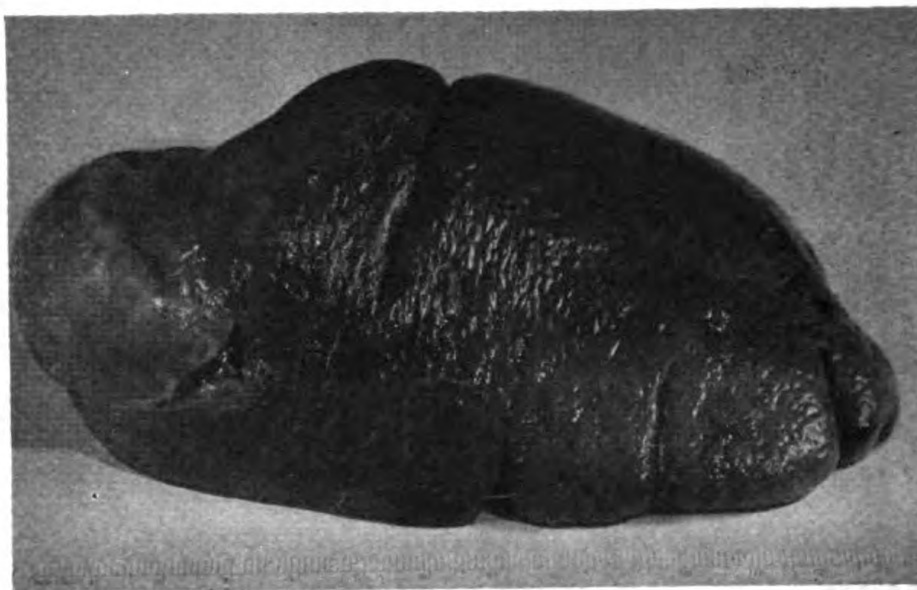
X-ray studies of the abdomen revealed a circumscribed partially calcified mass in the left upper quadrant just below the diaphragm: this mass was not connected with the stomach or kidney. An incidental finding on the intravenous pyelogram was evidence of the presence of a bifid renal pelvis on the left side (fig. 1.)

On 7 October splenectomy was carried out with the patient under spinal anesthesia. The abdomen was opened through a Fenger incision, and a moderately enlarged spleen with a hard tumor which was adherent to the diaphragm at its upper pole was found. Splenectomy was done without difficulty and with only slight oozing from the diaphragm.

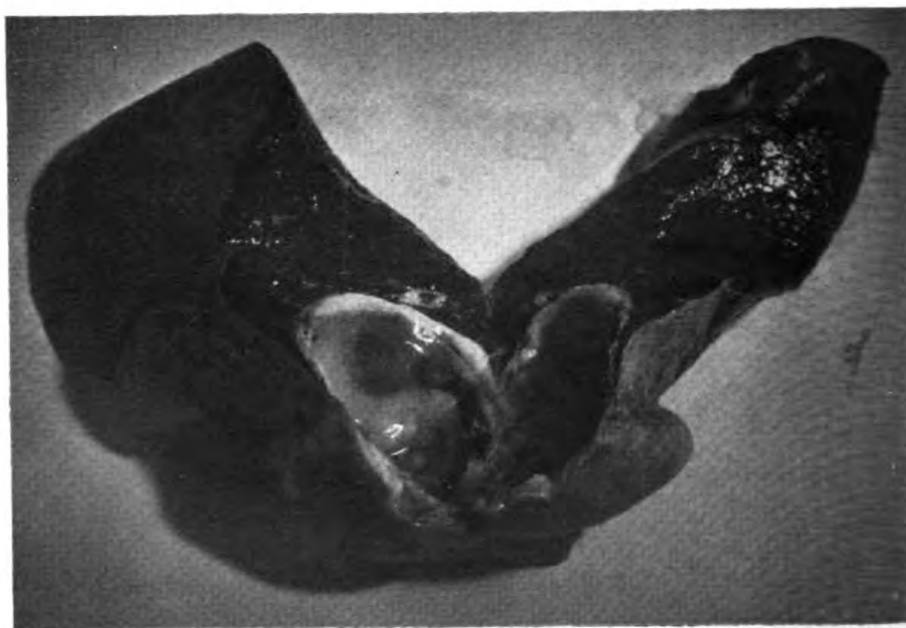


1. Preoperative intravenous pyelogram showing calcified cyst in left upper quadrant of the abdomen, and a bifid left renal pelvis.

The postoperative course was stormy for the first 5 days, with the temperature rising to a maximum of 103.6° F. on the second day, followed by a gradual fall to normal on the fifth day. The heart became irregular, due to ventricular extrasystoles almost immediately after operation, but an electrocardiogram made on the first postoperative day was reported otherwise normal. X-ray film of the chest on the second postoperative day revealed diffuse haziness in the base of the left lung, which was interpreted as being the result



2. Gross specimen removed at operation.



3. Spleen sectioned to show cyst in upper pole.

of the subdiaphragmatic procedure rather than a true pneumonia. After the fifth day convalescence became uneventful and the patient was returned to duty on the thirty-fifth postoperative day. On discharge he had no symptoms and the adenopathy noted on admission had disappeared.

The gross pathologic and the histologic examination showed the spleen, weighing 220 gm. and measuring 15 by 9.7 cm. (figs. 2 and 3), to have a calcified cyst measuring 5 by 4.5 by 3.5 cm. in the upper pole. The cyst wall varied from 1 mm. to 4 mm. in thickness. Although the lining was irregular and rough, with multiple yellowish-brown areas, there were no papillary projec-

tions. The surface of the remainder of the spleen was smooth and grayish-brown in color. The capsule was not thickened. On section the substance was friable and reddish-purple in color with normal markings.

On microscopic examination the wall of the cyst was found to be made up of dense fibrous tissue which showed extensive calcification. In some areas a distinct lining membrane of flat epithelium varying from one to three layers in thickness was present; in other areas the lining membrane appeared to be absent. The adjacent splenic tissue presented markedly dilated sinusoids filled with erythrocytes; the parenchyma was edematous and invaded by a small number of polymorphonuclear leukocytes and eosinophils. Other areas of the spleen showed only dilatation and congestion of the sinusoids.

SUMMARY

A case of calcified true cyst of the spleen occurring in an 18-year-old male has been presented. The incidental finding of a bifid renal pelvis on the left side raises the question of whether this cyst may not be the result of a congenital peritoneal inclusion as suggested by Fowler. The diagnosis was made preoperatively on x-ray evidence and the treatment was splenectomy.

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PENICILLIN INACTIVATOR

A penicillin inactivator has been extracted from 7 strains of penicillin-resistant *Staphylococcus aureus* obtained from clinical sources; 7 sensitive strains did not produce a penicillin-destroying substance. The penicillin inactivator passed readily through a Seitz filter. In terms of weight of the original powder, the staphylococcus extract was 10 times as potent as Clarase, a diastatic enzyme preparation with equivalent quantities; the rate of destruction of penicillin at 2° C., 22° C., and 37° C., was identical with both substances.—KIRBY, W. M. M.: Properties of penicillin inactivator extracted from penicillin-resistant staphylococci. *J. Clin. Investigation* 24: 170-174, March 1945.

DIFFUSE DEEP SUBMAXILLARY CELLULITIS TREATED BY PENICILLIN

REPORT OF A CASE

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It is believed that occasionally one case is of sufficient interest to record in the literature. Diffuse deep submaxillary cellulitis is not common, and the treatment of this case varied from that usually advocated. Williams,¹ and Williams and Guralnick,² having studied 51 cases at the Boston City Hospital, advocate surgical interference in all cases. Conway³ in reporting 3 cases treated by sulfonamides, modifies this viewpoint. No reports of cases treated by penicillin were found.

Case report.—A 33-year-old officer entered this dispensary on 24 July 1944 complaining of painful swelling in the right submaxillary region. For the past 6 years he had noticed intermittent swelling in this region just prior to eating; the swelling disappeared between meals. He had massaged the right submaxillary region during the previous episodes with good effect. He had not sought medical advice before the present illness. Two days before admission the right submaxillary swelling did not subside as usual but gradually increased, became painful, and greatly limited the motion of the lower jaw.

Examination on admission revealed diffuse swelling and tenderness with marked induration below the right mandible. The floor of the mouth was edematous but the tongue was of normal size. A small amount of pus was oozing from the ostium of the right submaxillary duct. It was difficult to open the mouth more than 2 centimeters. Respirations were normal and the patient was in no distress. He was able to swallow without difficulty. Examination did not disclose any other abnormalities. The temperature was 98.6° F., the pulse rate 80, and respirations 18 per minute.

The hemoglobin concentration was 80 percent, the erythrocyte count 5,380,000, and the leukocyte count 18,800, with a differential count of 75 percent polymorphonuclear leukocytes, 21 percent lymphocytes and 4 percent eosinophils. X-ray examination of the floor of the mouth by routine and dental films showed three calculi along the course of the right submaxillary duct.

¹ WILLIAMS, A. C.: Ludwig's angina. Surg., Gynec. & Obst. 70: 140-149, February 1940.

² WILLIAMS, A. C., and GURALNICK, W. C.: Diagnosis and treatment of Ludwig's angina. New England J. Med. 228: 443-450, April 8, 1943.

³ CONWAY, J. F.: Chemotherapy in management of Ludwig's angina. J.A.M.A., 118: 953-955, March 21, 1942.

Treatment consisted of application of heat to the affected region, warm mouth-washes, mild sedation, and 1 gm. of sulfadiazine every 4 hours, with sodium bicarbonate, grains 20, with each dose.

On the morning following admission, symptoms and signs had progressed markedly. The patient was unable to take the oral sulfadiazine at 0400. The swelling and induration under the right mandible had progressed, and movement of the mandible was further restricted so that the upper and lower teeth could be separated for a distance of only 1 centimeter. There was increased edema of the floor of the mouth, and the tongue was greatly swollen so that it filled the entire posterior oral cavity, making swallowing impossible. He was unable to breathe through the mouth, but there was a free airway through the nose. The temperature was 100.2° F., the pulse rate 80, and respirations 18 per minute. The leukocyte count had risen to 26,350, with 88 percent polymorphonuclear leukocytes.

A tracheotomy set was placed at the bedside, infusion of 1,500 cc. of 5-percent dextrose in distilled water was started, and 20,000 units of penicillin were administered intramuscularly. Arrangements were made for his transfer to a hospital by ambulance plane. The disadvantage of plane travel was carefully considered. The patient had done a moderate amount of flying and had never had air sickness. It was thought that the possibility of vomiting and the ensuing dire consequences would be remote at a low altitude. The advantage of eliminating a long ambulance trip with its attendant possible difficulties was thought to outweigh the possible disadvantages of plane travel. The trip was made by ambulance plane without incident. A medical officer was in attendance and a tracheotomy set was constantly at hand.

On arrival at the hospital, the patient was unable to talk except in a whisper and then with great difficulty. He appeared to be toxic and slightly cyanotic. There was no dyspnea, however. The underside of the right jaw was greatly swollen, very tender and indurated. The tongue and floor of the mouth were edematous. Palpation revealed that the right submaxillary duct was blocked by stones. The temperature was 102.8° F. by rectum. The leukocytes numbered 22,100 per cu. mm. of whole blood, with 74 percent polymorphonuclear leukocytes. Culture of the pus from the submaxillary duct showed nonhemolytic *Staphylococcus aureus* and streptococci. Cultures of the blood and urine were negative.

Penicillin, 20,000 units intramuscularly every 2 hours, and sulfadiazine, 1 gm. every 4 hours, were started. On the day following transfer, one small stone was spontaneously passed from the right submaxillary duct, and the following day two more stones were passed. Thereafter improvement was rapid and satisfactory.

On 28 July 1944, the third day following transfer, the patient felt quite well. The swelling had subsided greatly and the temperature was normal. His convalescence thereafter continued to be uneventful, and he was discharged to duty on 15 August. He had received a total of 720,000 units of penicillin. Repeated check x-ray views failed to reveal the presence of residual calculi in the submaxillary duct.

COMMENT

It is believed that there are several points of interest in connection with this case.

This patient was in a desperate condition and recovered with conservative treatment, i.e., without resort to surgery, in a re-

markably short time. While the result cannot be fully credited to penicillin, as sulfadiazine was also given, it is considered highly unlikely that such a favorable result would have been obtained had penicillin not been used.

A very high percentage, over 90 percent, of these cases are said to be secondary to a dental lesion, often following an infected tooth extraction. This case was somewhat unusual as it was secondary to infection of the submaxillary gland following blockage of the duct by three calculi.

Even though all cases are treated early by penicillin or sulfonamide drugs, or a combination of both, it is believed that surgical drainage will be indicated in a certain number. However a fair trial of conservative treatment, whenever possible, is deemed well worth while. When drainage is necessary, the problem of anesthesia is a difficult one. The infection is deep and hence requires deep dissection. It has been repeatedly pointed out that sodium pentothal or evipal are dangerous drugs to use in this type of case, or in any neck dissection, especially those in which there is danger of respiratory obstruction, because of the action of these drugs in depressing respiration, in combination with a possible effect on the carotid sinus. This point cannot be re-emphasized too strongly, in view of the increasing use of sodium pentothal and the alarming fact that it has been advocated as the anesthetic of choice in these cases by certain authors. Whether drainage is or is not necessary, preparation for immediate tracheotomy should be made.

Finally a word in support of those favoring purism in medical nomenclature as a means of avoiding confusion in classifying disease entities: It has been pointed out many times that diseases should be named according to anatomic and pathologic considerations rather than after some individual who may or may not have originally described the condition. It is realized that this is probably a hopeless struggle, as so many diseases have become fixed in medical literature with attached proper names. However we are not as resigned as Conway, in this respect and propose that patients fulfilling his definition of so-called Ludwig's angina, "an inflammatory process involving the floor of the mouth, deep to the mylohyoid diaphragm, as evidenced by elevation of the tongue, and producing a brawny induration of one or both submaxillary regions, with or without involvement of the submental region, which is obviously not confined within the lymphatics but bounded by tissue planes", be considered rather to have diffuse deep submaxillary cellulitis. The disease was recognized before Ludwig published his report of three cases.

In early stages of the disease, angina is a misnomer, in its usual connotation of distress from suffocation or choking attacks, and it may never appear in a large number of cases if the disease is recognized early and intensive chemotherapeutic measures are applied. Thus the disease is neither Ludwig's nor angina.



RESERVOIRS OF STAPHYLOCOCCUS INFECTION

For a long time it was held that the human skin was the primary source of staphylococci, especially the skin of sufferers from boils, styes, pimples, and so forth. But in the last 6 years it has become clear that the chief reservoir of potentially pathologic staphylococci is the anterior part of the nasal cavity. The carrier rates have for the most part been determined in hospital patients and staff, or in medical students. It is not uncommon to find from 30 to 70 percent of persons (patients and staff) in a hospital population carrying staphylococci in the nose. From 5 to 20 percent are skin carriers, and it is significant that skin carriage is most common in persons who are nasal carriers; these double carriers are usually infested in the nose and skin with the same subtype of staphylococcus. The same high rates apply to the civil population.—MILES, A. A.: Epidemiology of wound infection. *Lancet* 1: 809-814, June 24, 1944.



PARA-AMINOBENZOIC ACID IN SPOTTED FEVER

Experimentally, p-aminobenzoic acid given before or shortly after infection can prevent the appearance of clinical manifestations of the fatal Rocky Mountain spotted fever. In the large majority of test animals the visible symptoms (fever and scrotal reaction) were entirely absent. Nevertheless some afebrile guinea pigs showed pathologic lesions (splenomegaly, pneumonitis) typical of spotted fever. It seems that the absence or mildness of clinical symptoms indicates rather a suppressive than destructive effect of p-aminobenzoic acid on spotted fever rickettsiae with the result of (subclinical) infection. This phase of biochemic activity is associated with or followed by immune phenomena by which the guinea pig acquires active resistance to subsequent infection.—ANIGSTEIN, L., and BADER, M. N.: Para-aminobenzoic acid; its effect in spotted fever in guinea pigs. *Science* 101: 591-592, June 8, 1945.

ENCEPHALOMYELITIS COMPLICATING RUBELLA

REPORT OF A CASE

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German measles is generally considered to be one of the least serious of the contagious diseases which commonly occur in children and which are often observed in epidemic form in military units where large groups of young adults are thrown closely together. The course of the disease is short and complications are sufficiently uncommon to justify a highly favorable prognosis in nearly all cases of rubella. In spite of this usually favorable outlook, reports in recent years have shown that encephalomyelitis complicating rubella probably occurs more frequently than was formerly recognized. Margolis, Wilson, and Top¹ in 1943 reported 14 new cases and reviewed 34 previously reported cases, without, however, including two nonfatal cases reported by Bradford² earlier in the same year.

The present report of one case brings the total number of reported cases to 51, of which 10 were fatal, giving a combined fatality rate of 19.6 percent. The following case may be taken as fairly typical of post-rubella encephalomyelitis, except that the patient failed to exhibit the low-grade fever (99°-103° F.) commonly seen in this complication of German measles.

Case report.—A 24-year-old SPAR yeoman, third class, was admitted to the Coast Guard Academy Hospital on 9 February 1944 with a rash of approximately 12 hours' duration. Physical examination showed a diffuse macular rash over the face and trunk and enlarged postauricular lymph nodes. The patient's temperature was 98.6° F., the conjunctivae were normal and no Koplik's spots were present. The leukocyte count on the day after admission was 5,150 with 78 percent neutrophils, 13 percent lymphocytes, 4 percent monocytes, 4 percent eosinophils, and 1 percent basophils. The rash present on admission rapidly faded during the next 48 hours and the patient was discharged from the hospital on 12 February to return to full duty.

Four days later the patient was again admitted complaining of occipital headache which had its onset 2 days previously and which had become progressively more severe. She stated that the headache radiated forward to her eyes; her neck was somewhat stiff, and she had had slight nausea but no vomiting.

¹ MARGOLIS, J.; WILSON, J. L.; and TOP, F. H.: Post-rubella encephalomyelitis; report of cases in Detroit and review of literature. *J. Pediat.* 23: 158-165, August 1943.

² BRADFORD, R. I. C.: Two cases of rubella meningoencephalitis. *Brit. M. J.* 1: 312-313; March 13, 1943.

Physical examination on this admission showed no signs of any rash. There was a moderate degree of photophobia and well-defined stiffness of the neck muscles, but Kernig's sign was absent and further neurologic examination showed no abnormalities. The patient's temperature was normal on admission and remained so during the entire period of hospitalization.

Lumbar puncture performed 2 hours after admission showed an initial pressure of 240 mm. of water with normal fluid dynamics. The pressure was reduced to 170 mm. by the withdrawal of 7 cc. of clear fluid. Immediate examination of the spinal fluid showed 40 cells per cu. mm., all cells being lymphocytes. Following the lumbar puncture, the patient gained great temporary relief from the headache, which, however, again became quite severe during the next 12 hours. On 19 February diplopia became manifest for the first time, but this symptom gradually disappeared during the next 5 days, and otherwise the patient developed no signs or symptoms not present on admission.

Fifty cubic centimeters of 50-percent dextrose was given intravenously on two occasions to relieve the patient's headache, with but little success. On 22 February a second lumbar puncture showed an initial pressure of 130 mm. of water. The pressure was reduced to 100 mm. by the withdrawal of 4 cc. of clear fluid which on laboratory examination showed less than 10 cells per cu. mm., all lymphocytes. Repeated blood examinations were reported as follows: On 17 February the leukocyte count was 9,700, with 54 percent neutrophils, 27 percent lymphocytes, 13 percent monocytes, 4 percent eosinophils, and 2 percent basophils. Two days later the leukocyte count had risen to 12,550 with 82 percent neutrophils, 9 percent lymphocytes, 8 percent monocytes and 1 percent eosinophils. On 21 February the leukocyte count was 9,800, with 57 percent neutrophils, 35 percent lymphocytes, 6 percent monocytes and 2 percent eosinophils.

The patient began to show rapid improvement on 23 February and 3 days later was discharged, entirely asymptomatic and with no abnormalities on physical examination. Recheck examination 4 weeks later did not reveal any abnormality.

Despite the mild course in the present case, encephalomyelitis following any form of measles carries a high mortality and in survivors a permanent paralysis may occur. Fortunately the complication is rare; the 50 reported cases indicate the still greater infrequency of the post-rubella incidence.



PENICILLIN INTRAPERITONEALLY

Penicillin given by the intraperitoneal route in a single dose of 100,000 Oxford units is detectable in the blood stream in sufficient amounts to neutralize penicillin-sensitive invaders in abdominal surgery. The absorption of the instilled penicillin from the peritoneum into the blood stream takes place over a longer period and is more sustained than the intramuscular or the fractional intravenous routes. Peak levels are reached 30 minutes after instillation. Amounts of penicillin sufficient to combat penicillin-sensitive organisms are found 3 hours after administration.—GREENE, H. J., and ALTURE-WERBER, E.: Penicillin as prophylactic in abdominal surgery. *Proc. Soc. Exper. Biol. & Med.* 58: 211-212, March 1945.

CHEEK BITING

REPORT OF A CASE

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Reaction to the human bite varies, depending upon the source of the bite, virulence of the organisms, resistance of the host, and the area involved. It is not within the province of this paper to discuss these various factors but to call attention to the fact that cheek biting may be overlooked in the diagnosis of lesions of the mouth.

This self-inflicted traumatic lesion of the cheek is usually a rather benign condition, causing discomfort only during eating and drinking. However, undiagnosed, it may result in loss of time and energy on the part of the doctor and prolonged discomfort to the patient.

Case report.—The patient, 23 years of age, was admitted to the hospital with a tentative diagnosis of leukoplakia. He was ambulatory upon admission. The blood pressure was 140/60, the temperature 98.7, pulse rate 78, and respiration 16 per minute. His chief complaint was a sore mouth.

The original health record had been lost somewhere in the South Pacific. The family history was irrelevant. He stated that he had had measles, mumps, chickenpox, and gonorrhea. He said he smoked considerably. He had had a bilateral repair for inguinal hernia, but he had suffered no injuries of any magnitude.

The sore mouth was of 10 months' duration, varying in severity. It seems to have been worse after landing operations. Upon examination the mucous membrane of each cheek presented a ragged appearance, with patches of gray, elevated, rolled tissue, and small denuded areas showing congealed blood upon the surface. This nonmembranous lesion was not particularly sensitive at the time of the patient's admission.

The patient stated that 4 or 5 days after D-day on Tarawa he noticed that the mucous membrane of each cheek had become painful. Eating and drinking became a source of irritation. The medical officer treated the lesion with gentian violet, and the patient was transferred to Hawaii where he was treated by the dental and medical officers with silver nitrate and mouth-washes. Vitamins were added to the regular diet. There was no response to treatment, and the diagnosis remained unchanged. He was discharged back to his regiment, where the battalion surgeon treated the condition with dye and recommended soft foods. A slight improvement was noted in the condition.

Following D-day on Saipan the condition became worse. There was no change in treatment, and as he evidenced no improvement, he was transferred to a base hospital in the Kwajalein Islands where he received no specific treatment. Finally he was evacuated to Pearl Harbor. Here he came under

the care of a skin specialist. His mouth was "painted" (patient's description) with no evident improvement. Following this local treatment the patient was given five injections of penicillin with no effect. He later received seven injections of a bismuth preparation with no result and the silver nitrate and gentian violet treatments were resumed.

Following all this unsuccessful treatment, the patient was returned to the United States. He was admitted to this hospital with diagnosis undetermined and was referred to the dental department, where a diagnosis of cheek biting was made. It was thought that the condition was the result of nervousness, perhaps complicated by intestinal parasites, and a stool was examined but found to be negative. In order to verify the diagnosis and to rule out any possibility of trauma by the teeth it was decided to wire the jaws together.

This was done, the patient was placed on a liquid diet, and warm normal saline solution mouthwashes were recommended. The patient was very cooperative. By the following day the condition was much improved and within 3 days it was so much improved that the diagnosis was considered confirmed. On the following day the wires were removed. The diagnosis was now changed to cheek biting, and the patient was recommended for duty, following a period of rest.

The differential diagnosis of mucous membrane lesions of the mouth can be a difficult problem. But it is logical to believe that the more simple local complications should be ruled out before the establishment of a tentative diagnosis requiring complicated systemic treatment.



SPREAD OF INFECTION

Streptococcal carriers broadcast streptococci from the throat during the droplet explosions that occur in talking, coughing, and sneezing. Throat carriers of staphylococci are rare, less than 1 percent; so the nasal staphylococci depend on the occasional sneeze for broadcasting by droplets and droplet nuclei. The real broadcasters are the hands. They carry staphylococci more frequently than any other part of the skin, except the skin of the face; and in some persons they carry it in the deeper recesses of the skin.

The hand has innumerable opportunities for getting loaded with staphylococci. In prewar days some observations of subway train passengers showed how many handled their noses in a 10-minute period. It varied from 10 to 60 percent and a quiet survey of any gathering will convince the observer of the assiduity with which even the socially irreproachable will contaminate their hands with the invisible flora of the external nares.—MILES, A. A.: Epidemiology of wound infection. *Lancet* 1: 809-814, June 24, 1944.



SIXTY-DAY ERUPTION OF A LOWER SECOND MOLAR

Roentgenographic examination of a 19-year-old Naval Academy midshipman revealed that both second and third left lower molars were impacted. Under local anesthesia the third molar was removed. The incision for the flap included the occlusal surfaces of both the second and third molars. Before inserting the sutures following removal of the third molar, the entire occlusal surface of the second molar was exposed by trimming the tissue surrounding it.

Ten days later, under local anesthesia, the margins of the tissue surrounding the second molar were again trimmed, allowing freer eruption of the second molar. There were no postoperative complications. In approximately 2 months after the extraction of the third molar, the second molar had assumed the normal relation to the opposing teeth in the upper arch.—RUSK, W. S., Lieutenant (DC) U.S.N.



"DUCK-WADDLE" THERAPY FOR LOW BACK PAIN

Observing that knee-chest positions and walking on all "fours" frequently relieved pains in the lower abdomen and back in pregnant women and in women whose uterus was retroverted or retrodisplaced, various positions and exercises were experimented with in order to find one which would be helpful in relieving sacro-iliac pain. The position of squatting on one's haunches and placing the arms so that the hands touch the deck parallel to and lateral to the knees for support proved most satisfactory in relieving back pain. The patient is advised to "waddle" with the head and shoulders bent slightly forward in the crouch position until fatigued. Most patients can continue the exercise on first trial for only 2 or 3 minutes. However they are advised to increase the length of time of exercise by 1 minute daily until exercising for 10 minutes. Acute sacro-iliac pain is relieved almost immediately on merely assuming the position.—SCHUSTER, B., Lieutenant Commander (MC) U.S.N.

MEDICAL AND SURGICAL DEVICES

MOBILE SURGICAL UNITS FOR AMPHIBIOUS WARFARE

WALTER L. MERSHEIMER
Lieutenant (MC) U.S.N.R.

The mobile surgical units of the trailer type are no doubt an outgrowth of the hospital trains of World War I. The literature has been reviewed (1) (2) (3) (4) (5) (6) and from this investigation the conclusion was made that these vehicles were designed primarily as sickbays with few facilities for major surgery. It has also been noted that in no instance has there appeared a report of surgery being performed in such a unit. For these reasons it seems logical to record the experiences gained in a mobile surgical unit. That, together with the revision of this trailer, and the design and construction of a new mobile unit for major surgery, is the purpose of this paper.

In the Marshall Islands, during the period from April to November 1944, about 30 operations were performed in a unit constructed by the enlisted personnel of the First Defense Battalion, Fleet Marine Force, Pacific. This trailer was originally designed to function as a sickbay rather than an operating room (6). During the early phases only minor surgery was performed because maintenance of asepsis was doubtful. However the good results obtained proved this tenet to be groundless. Therefore procedures of a more serious nature were undertaken.

Eventually it became accepted that a mobile surgical unit was suitable for all types of major surgery. The operative procedures undertaken included mastectomy, inguinal herniorrhaphy, circumcision, hemorrhoidectomy, debridement and suturing of wounds, tenorrhaphy, reduction of simple fractures, and stump revision of a traumatic amputation of the arm.

Spinal or infiltration anesthesia was used for all these cases. The only operative complication, a superficial wound infection following an inguinal hernioplasty, was attributed to a break in asepsis which was brought about by limited operating-room space.

As a result of these experiences the following disadvantages of the unit were noted: (1) The size of the operating area was in-

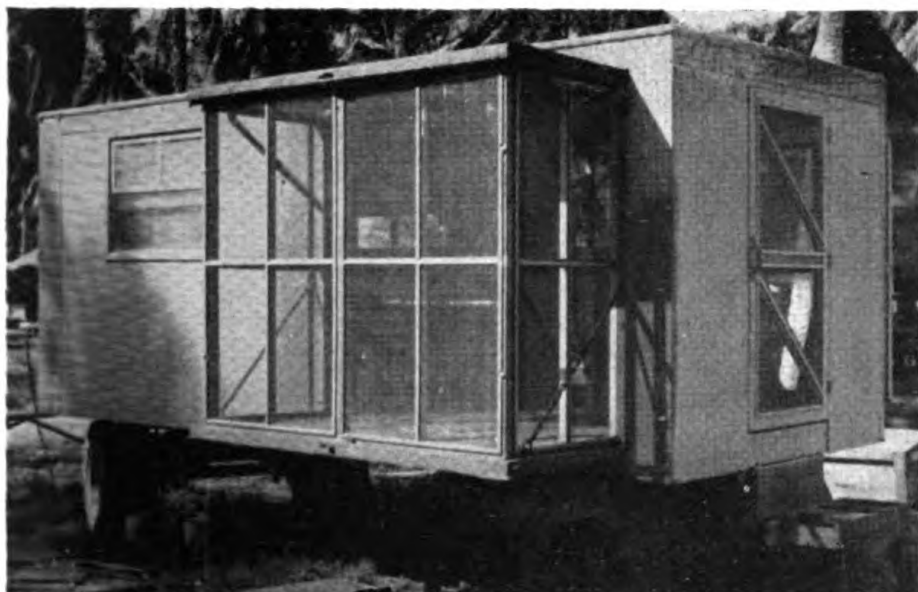


1. Converted radar-van mobile surgical unit; front view.

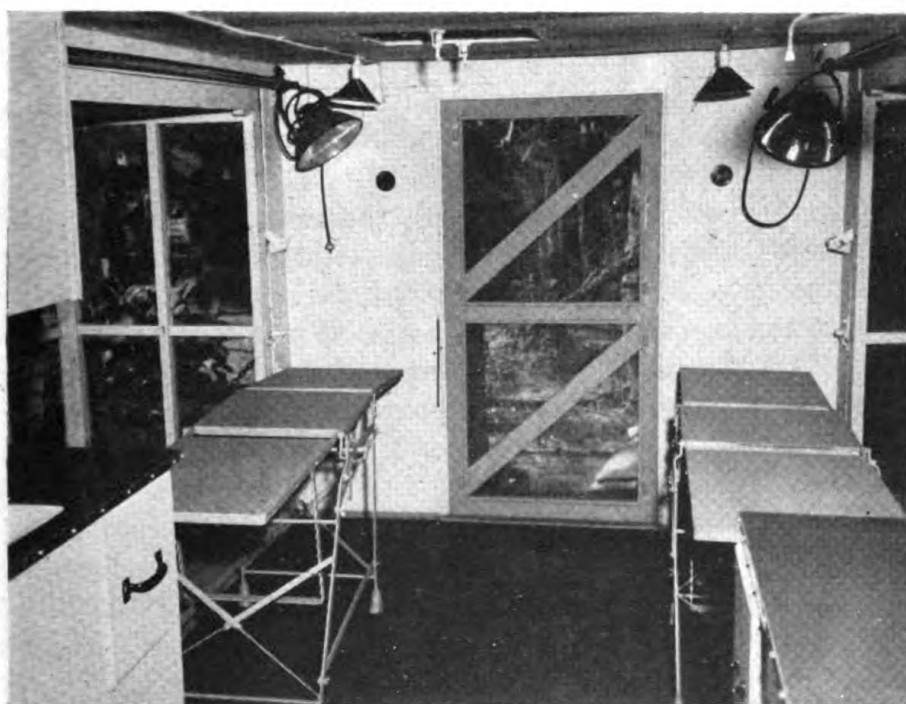


2. Rear view of mobile surgical unit assembled for traveling.

adequate; (2) illumination of the operative field was poor; (3) the Pullman-type scrub basin did not facilitate maintenance of



3. Sectioning of bulkhead and installation of prefabricated screens permit doubling of operating deck space.



4. Interior view of mobile surgical unit. Observe mounting of Castle lights.

aseptic technic; (4) the record desk and file cabinet were never used and merely occupied space which could be utilized to greater advantage; (5) the water tanks were mounted topside in an extremely vulnerable position and increased the transportation stowage factor by eight measurement tons; and (6) a two-wheel

trailer increased the debarkation hazard as the stern impinged on the landing ramp.

This unit has been remodeled and it is believed that most of the defects have been corrected. The structural changes include: (1) Removal of splint locker, record desk and file cabinet; (2) the after-door was eliminated; (3) the port and starboard lockers have been moved flush with the after bulkhead, occupying the space gained by removal of the record desk, file cabinet and splint locker; (4) a number of drawers were sacrificed to give increased locker space; (5) a rectangular rustproof water tank was mounted on the bulkhead inside the trailer and the topside tanks eliminated; (6) the Pullman-type basin was removed and a conventional type stainless steel scrub basin installed; (7) an elbow-operated water faucet was installed; (8) three Castle spotlights were mounted on the bulkheads in place of the bank of conventional lights; (9) a gasoline-fueled 1,500-watt electric generator was permanently mounted on the trailer hitch.

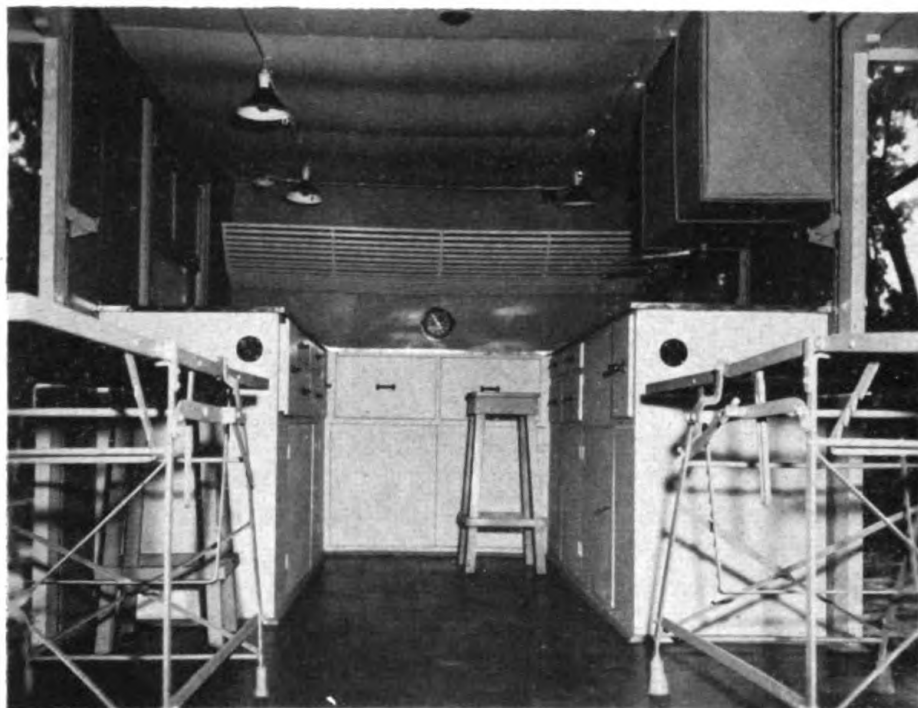
As a result of these changes the operating room area has been increased by 16 square feet. Illumination of the operative field is now adequate. There is ample space for the stowage of large surgical chests while still maintaining adequate drawer space for the storing of smaller items, and the generator fulfills all electric requirements. At present this mobile surgery is serving with the field hospital of the Sixth Marine Division.

Despite these improvements not all the shortcomings have been eliminated, for which reason a completely new mobile surgery was designed and constructed embodying many new and distinctive features.

An Army radar van was obtained from a salvage depot and converted by the 518th U. S. Naval Construction Battalion Maintenance Unit. The accompanying illustrations show the manner in which port and starboard bulkheads open and the method by which prefabricated screens are secured in position to increase the beam from 8 to 15 feet. The change can be accomplished in less than 10 minutes and gives the operating room an area of 150 square feet as compared with 80 square feet in the remodeled trailer. When the need arises this space is ample for the performance of two operations simultaneously.

The manner of mounting the four Castle lights on the two horizontal bars, rather than the conventional vertical bars, is unique. It can be seen that all four may be focused to illuminate one operative field or they may be adjusted to provide light for both tables.

There are two removable bulkhead-mounted instrument trays



5. Interior view of mobile surgical unit showing arrangement of lockers and work tables.

which may be rotated to any desired position. The large rectangular scrub basin is under the water tank and the 55-gallon capacity of the tank provides under normal conditions sufficient water for about 30 surgical scrubs.

Construction of the lockers to a convenient depth permits the utilization of the top surface as a work table. The locker space was designed to hold 6 surgical chests, each of which is completely stocked to perform a major operation. In addition there is ample space for the autoclave, instrument sterilizer, suction apparatus and bulky supplies, such as plasma and saline. The luggage-rack type of shelf on the forward bulkhead is used to carry additional sterile gowns, drapes, towels, and gloves.

A gasoline-fueled 1,500-watt electric generator has been installed outboard on the forward bulkhead and supplies all necessary electric power. Wiring is so arranged that instantaneous hook-up is possible to a 7.5 kv. skid-mounted or trailer-type generator. Emergency lighting depends on the use of portable battle lamps (battery), and Coleman lanterns. Air conditioning and gas decontamination is provided for by a collective protector of the M3 type with an M2 cannister (7).

Complete blackout is obtained by securing plywood panels to the screens, the door, and forward ports. During transportation, screens and blackout panels are carried inside the vehicle.

The trailer is completely sprayed with DDT solution, including screens, lockers, and drawer space.

Tests have shown that a 2½-ton, 6 by 6 prime mover is the most satisfactory means of hauling the trailer, although a 1-ton, 4 by 4 ambulance will suffice. Speeds easily up to 35 miles per hour have been recorded over dirt and coral roads. Beaches and fords have been navigated readily.

It is beyond the scope of this paper to give a detailed description of the equipment and supplies stowed. Broadly stated, the unit is self-sustaining in every respect. It is complete with surgical instruments and supplies to perform 6 operations without re-sterilizing instruments and to do 12 major cases without re-sterilizing linens. Electric autoclave, instrument sterilizer, and suction apparatus are aboard. Splints, oxygen tank with Boothby mask, transfusion and intravenous sets, plasma, saline, and pharmaceuticals are carried in adequate amounts.

ACKNOWLEDGMENTS.—Appreciation is extended to the officers and enlisted personnel of the 518th U. S. Naval Construction Battalion Maintenance Unit, Lieutenant J. E. Pecore (CEC) U.S.N.R., Commanding, for the construction of the new trailer and the remodeling of the older unit, particularly to Lieutenant Commander R. B. Cooke (CEC) U.S.N.R.; Warrant Officer W. E. Ford (CEC) U.S.N.R.; and J. Smith, Chief Carpenter's Mate U.S.N.R. The author is indebted to Lieutenant R. R. Schubert (MC) U.S.N.R., for his excellent suggestions.

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MOBILE DISPENSARY FOR LCTS

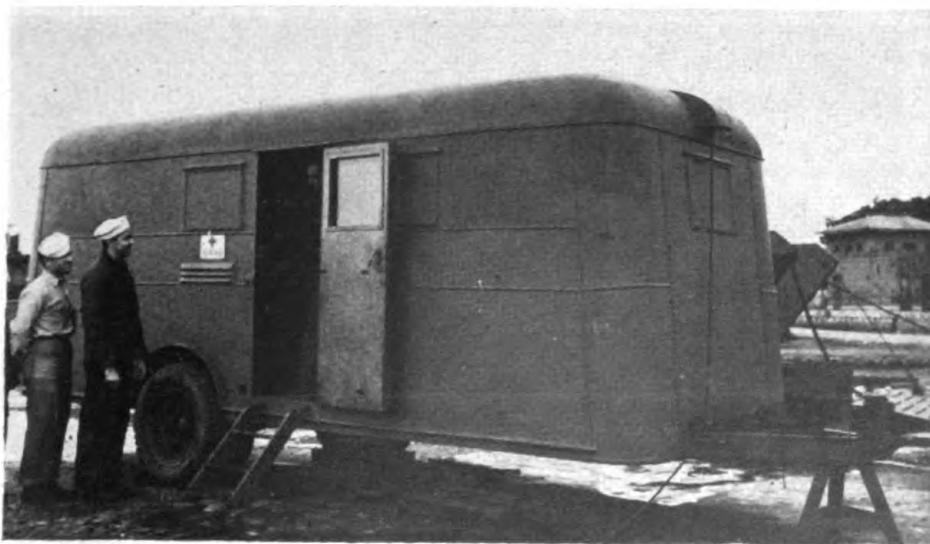
CHARLES A. THOMPSON

Lieutenant, junior grade (MC) U.S.N.R.

After several months of caring for the sick and injured on LCTs in the Mediterranean area, a mobile dispensary has been found most satisfactory.

A one-axle, dual-wheel, plywood trailer was acquired and converted into a mobile dispensary. The trailer weighs $2\frac{1}{2}$ tons, is 20 feet long, 7 feet wide, and could be pulled by a jeep, but required a large truck to roll it aboard the LCT. The following equipment was installed:

1. A small oil-burning heating unit using 1 gallon of fuel oil daily in moderately cold weather.
2. A 30-gallon water tank connected to a hand-powered faucet pump and sink.
3. Electric fixtures, powered from the LCT or some shore generator.
4. A built-in bunk for examination purposes and sleeping of the night watch.
5. Medical officer's hanging wall desk.
6. Small dispensing pharmacy containing the common remedies.



1. A trailer converted into a mobile dispensary.

—U. S. Coast Guard Photo.



2. The examining bunk and medical officer's desk occupy the after half of the trailer.

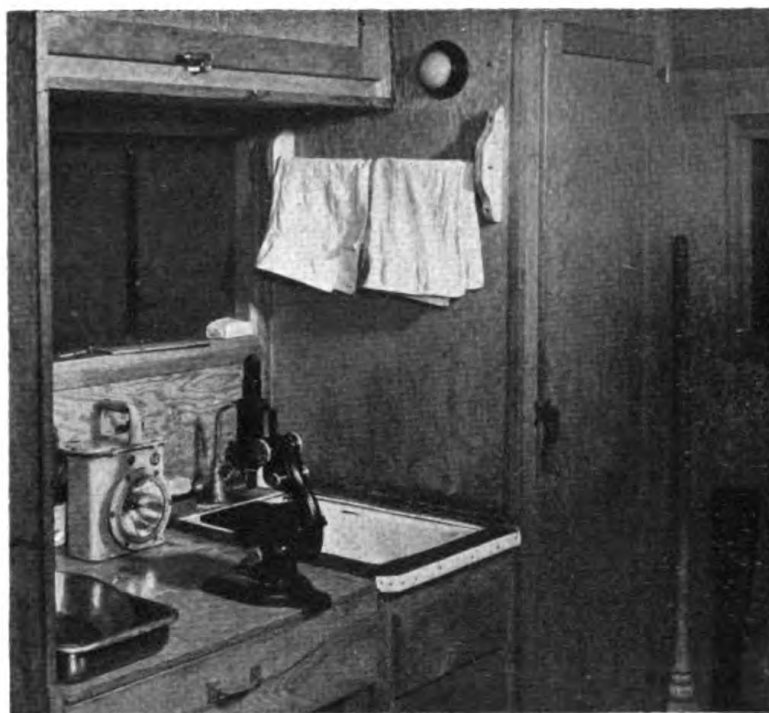
—U. S. Coast Guard Photo.



3. The dispensing pharmacy, treatment table, records department, stretcher, and emergency pouch occupy forward end of the trailer.

—U. S. Coast Guard Photo.

7. Small treatment table with the necessary equipment, including a sterilizer.



4. The small laboratory and sink with a large storage closet is likewise located in the forward half of the trailer.

—U. S. Coast Guard Photo.

8. Laboratory containing the necessary equipment to do routine blood and urine analyses, and smear examinations.

9. Storage space for casualty supplies.

10. Desk and filing drawers for the health records, with equipment necessary to keep the health records and other records up to date.

11. Stretcher and wooden horses to be used as a temporary operating table when needed.

Conversion of the trailer into a sickbay was accomplished using salvaged equipment and the medical staff's spare time. The mobile unit remained ashore while the boats were engaged in shuttle service or maneuvers, and served as a central sickbay for all LCT personnel. When the flotilla moved to another area, the trailer was loaded aboard and secured to the deck of the LCT where it was available for any emergency during the convoy. At the destination it was moved ashore until further transfer of the boats.

Because of the frequent movements of the ship and because space on an LCT cannot be conveniently converted into, or used as a sickbay, and in order to get a central point of organization of the Medical Department, the mobile unit was established and has proved successful.

APPARATUS FOR INTRAVENOUS ANESTHESIA

MANAGEMENT OF LARGE SCALE CASUALTIES

PAUL A. KAUFMAN

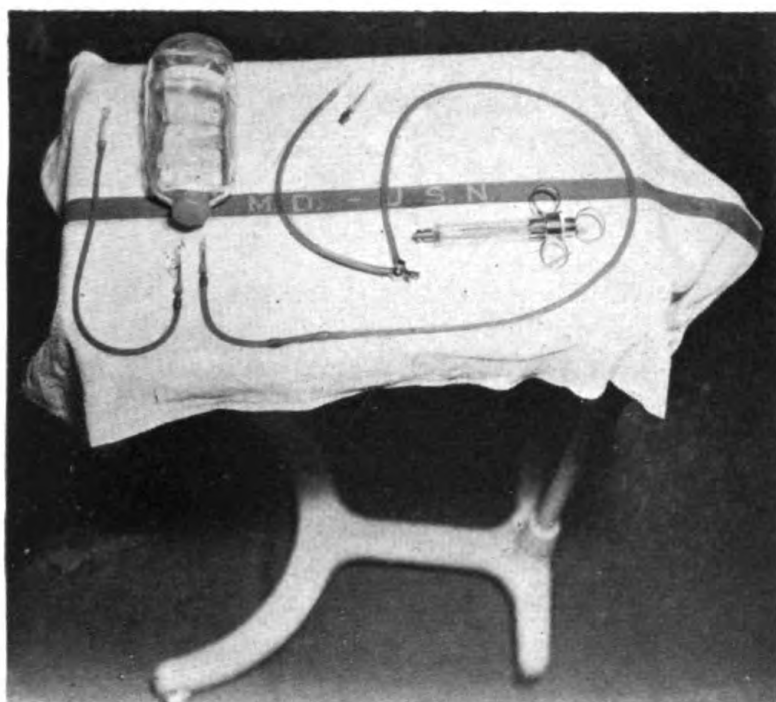
Surgeon (R) U.S.P.H.S.

Intravenous barbiturates provide one of the most suitable types of anesthetic for military surgery at advanced medical facilities. As usually administered a 2½-percent solution of sodium pentothal is given slowly by syringe. This method, despite simplicity, has the disadvantage of requiring many sterile syringes, frequent manipulation in changing syringes during an anesthesia which exposes to spillage and dislocation of the needle, and there is difficulty in administration of 1 or 2 cc. of solution when a 20- or 50-cc. syringe is used. It is awkward and tiring, moreover, for the anesthetist, reducing the amount of attention he may direct toward the patient's condition regarding respiration, color and the like; and it creates difficulty in preventing blood reflux and clotting during the stage when injection has been temporarily discontinued.

Numerous devices have been recommended to overcome one or more of these difficulties and some of these are entirely satisfactory in a base hospital, but they are not available at forward areas. For this reason a search was made for an apparatus consisting of materials available at every first-aid station, such as may be salvaged from a standard plasma transfusion outfit. The only additional fitting required is a three-way stopcock which should be readily obtainable.

In assembling the unit the following steps are taken:

1. The supporting tape used to suspend the liquid plasma is removed from that bottle and placed on the empty bottle which formerly contained the sterile water.
2. Any desired quantity of 2½-percent sodium pentothal solution is introduced into the bottle which acts as a reservoir.
3. The breather tube used to allow air to enter the plasma bottle is similarly introduced into the sodium pentothal reservoir, after which the bottle can be inverted and suspended.
4. The long tube formerly used to convey plasma from the bottle to the vein is sectioned 25 cm. proximal to the glass adaptor tip. The long segment containing the filter is attached to the inlet of the three-way stopcock, while the needle at the other end is inserted into the suspended sodium pentothal reservoir.



1. (Above). Disassembled units of intravenous anesthetic apparatus.



2. (Right). Intravenous administration of anesthetic. Complete setup of apparatus.

5. The 25-cm. segment is then attached to the outlet of the three-way stopcock and the glass adaptor attached to the same needle used for the administration of plasma.

6. A 10-cc. syringe is attached to the three-way stopcock and manipulated in order to fill the entire tubing system with anesthetic solution, after which the plunger is withdrawn to the 10-cc. mark.

The technic of venipuncture is identical with that used in plasma administration, the needle being secured by several strips of adhesive. Since the tubing system is filled before the vein is punctured, the amount of solution injected can readily be followed on the 10-cc. syringe scale. When empty, the syringe is refilled from the suspended reservoir by manipulation of the three-way stopcock. Blood reflux during waiting periods can be prevented by a slight turn of the stopcock. The tubing between the vein and the syringe may be bent in the form of an inverted "U" so that the anesthetist can sit at the head of the table where he may support the patient's jaw more readily.

Provided blood reflux is limited to the rubber tubing immediately adjacent to the needle, the main apparatus can be utilized for many successive cases by the substitution of a new intravenous needle and tubing segment from the needle to the stopcock for each subsequent case. These replacement setups may be reclaimed from other plasma outfits and sterilized in large numbers in anticipation of their use.

EDITORIALS

CHEMICAL MECHANISM OF INFLAMMATION

The mnemonic, *dolor, calor, rubor, tumor et functio laesa*, depicts the clinical sequence of inflammation, the chemical basis of which until recently has escaped experimental verification.

Tissue response to an irritant initiates the succession, the reaction being characterized primarily by increased fluid passage through the capillary endothelial wall. The distorted physiologic action is probably brought about by a local axon reflex set up by the irritation and resulting in modification of the caliber of the arterioles. A rise in capillary pressure follows.

Menkin^{1,2} in his exhaustive work on this subject has demonstrated the presence of a crystalline nitrogenous substance liberated in the area of acute inflammation. It is capable of increasing capillary permeability and of prompting a leukocytic migration at the site of injury. Because of this local migration and diapedetic property it is called leukotaxine.

Along with the infiltration, free passage of plasma proteins from the circulation into the extracapillary spaces occurs. Fibrinogen accumulates and is converted into fibrin through the agency of thrombokinase from the injured tissue. A fibrinous network forms in the distended tissue, and lymphatic channels become plugged. Fixation of the irritant in a walled-off area in this manner permits the relatively sluggish leukocytes to assemble for the purpose of phagocytosis and for their contribution to immunity.³

Although phagocytosis and leukocytosis are not invariable accompaniments of inflammation, their association is so consistent that an acute process is inferred whenever they are found.

¹ MENKIN, V.: Studies on inflammation; mechanism of increased capillary permeability. Critique of histamine hypothesis. J. Exper. Med. 64: 485-502, September 1936.

² IDEM: Studies on inflammation; isolation of factor concerned with increased capillary permeability in injury. J. Exper. Med. 67: 129-144, January 1938.

³ EDITORIAL: Cellular aspect of immunity. U. S. Nav. M. Bull. 45: 365-366, August 1945.

Observations,⁴ however, indicate that the heightened leukocyte level in the blood stream during acute inflammation is referable to the liberation at the site of injury of a third substance distinct in origin and fractionation from leukotaxine. This leukocytosis-promoting factor is thermolabile and seems to be a pseudoglobulin or at least is closely associated with that fraction of exudate. On absorption it induces not only an outpouring of immature leukocytes from the bone marrow but effects a hyperplasia of granulocytic and megakaryocytic elements as well.

On the other hand neither leukotaxine nor the leukocytosis-promoting factor, either singly or combined, is capable of reproducing the essential characteristics of inflammation. Necrosin,⁵ a fourth exudative product, when introduced under the skin brings about an intense redness, edema and superficial necrosis. It is apparently derived from, or at least is associated with, the euglobulin fraction of inflammatory exudate, and is toxic. When injected intravenously in experimental animals it may produce lung, gastro-intestinal, liver or renal damage. Foci of necrosis develop, which fact suggests the possible relation between the passage of necrosin into the circulation from a site of inflammation and the dissemination and systemic complications following local infection.

Menkin⁶ found, however, that the whole euglobulin fraction of the exudate was not composed of necrosin. When the ammonium sulfate-exudate precipitate is treated with distilled water, an insoluble fraction is obtained which is subjected to dialysis through a cellophane membrane. The residual material when injected into animals is pyrogenic, inducing a high fever, for which reason it is called pyrexin. As Menkin has inferred, pyrexin may well be an end product of proteolysis initiated by necrosis. Its absorption, however, offers a reasonable explanation for the development of fever in inflammation.

The phenomenon of inflammation therefore may be considered as a manifestation of severe local injury in which cellular metabolism is deranged. The damaged cell exhibits an alteration of its internal chemistry allowing the liberation of various by-products of metabolism, namely, leukotaxine, leukocytosis-producing factor, necrosin and pyrexin. These in turn initiate the basic pattern of inflammation expressed in the clinical sequence, pain, heat, redness, swelling and disordered function.

⁴ MENKIN, V.: Studies on inflammation; on mechanism of leukocytosis with inflammation. *Am. J. Path.* 16: 13-32, January 1940.

⁵ MENKIN, V.: Chemical basis of injury in inflammation. *Arch. Path.* 36: 269-288, September 1943

⁶ IDEM: Significance of biochemical units in inflammatory exudates. *Science* 101: 424-425, April 27, 1945.

SCHISTOSOMIASIS JAPONICA

As the war progresses westward schistosomiasis becomes a menace to military personnel. Although at the present time the infection has not proved serious in the Navy, it may attain major importance as endemic centers are reached. The disease is potentially comparable in magnitude to filariasis and certainly is more serious in its prognosis; very heavy infection may result in death, and the sequelae of lighter infection may persist for the life of the patient, finally acting as a contributing cause of death.

Believing that knowledge of the cause is the single most effective preventive factor in the spread of the disease, the Navy has instituted extensive indoctrination of all Naval personnel regarding the causative agents, their distribution, habits, life cycle and infectivity. Stress is placed upon the quality of fresh water with which one may come into contact, whether for drinking purposes, washing, wading or any other reason dictated by military necessity. Unless certain of its freedom from specific infected snails and unless special precautions are taken, avoidance of the water is strongly urged. Ordinary clothing as a safeguard is no longer viewed with confidence, infection having been shown to occur even when the skin was protected by cloth leggings.

Unlike filariasis there is an active therapy provided; with it, however, best results are had when diagnosis is made early. As Hunt has pointed out elsewhere in this BULLETIN, p. 407, schistosomiasis may masquerade under many a familiar symptom complex, making early diagnosis most difficult.

Inasmuch as specific diagnosis can be made only on the recognition of characteristic ova in the feces and as there is considerable lag between infection and the appearance of ova in the feces, any method which can speed up their recovery in stool specimens is most important. Furthermore, as pointed out in Hunt's cases, when there was tentative clinical evidence for the diagnosis of schistosomiasis the ova were observed only after from 2 to 17 specimens of the patient's stool had been examined.

Unfortunately no reliable specific laboratory test has thus far been devised for determining the presence of the disease during its incubation period. Approximately six weeks must pass in some instances before the disease can be diagnosed with certainty. During this time clinical history and symptoms must be relied upon and these are characterized only by their great variability. Moreover the problem is complicated by the fact that many of the tropical diseases may give similar symptoms.

Consequently McCorkle's modification of the Faust-Meleney technic as described in this BULLETIN, p. 420, is a significant

contribution. It is apparent, however, that the test is beyond the inexperienced laboratory worker. Recognition of schistosomal species by their miracidia is difficult, and certainly this becomes more perplexing when diagnosis must depend upon the swimming habits of the organisms. Even recognition of the ova under the microscope is not easy and requires considerable training. This becomes more difficult when specimens are obtained from patients living in an oriental environment where intestinal parasitic infection is widespread.

Despite the technical limitation, however, McCorkle's hatching method has a confirmatory value, particularly when only a few ova are observed. Routine application under these conditions is worth while and may lead to an early diagnosis when other methods fail.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

A **MANUAL OF TROPICAL MEDICINE**, Prepared Under the Auspices of the Division of Medical Sciences of the National Research Council, *Colonel Thomas T. Macie, M.C., A.U.S., Executive Officer, Tropical and Military Medicine, Chief, Division of Parasitology, Army Medical School; Major George W. Hunter, III, Sn.C., A.U.S., Division of Parasitology, Army Medical School; and Captain C. Brooke Worth, M.C., A.U.S., Division of Parasitology, Army Medical School.* 727 pages; 284 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1945. Price \$6.

During these times of war scarcities and priorities, we have learned to appreciate the difficulties of publishers of medical books. New instruments and drugs for the military medical services have had high priority, but new books or new editions have had to compete with scores of other users of printing paper. An appropriate slogan might be: "If you don't give the doctors new books, how can they use the new drugs and instruments."

This manual shows an appreciation of the need of conserving space. Separate chapters are not given blank spaces for commencement and ending, and the margins are restricted. The chapters follow in numbered succession, but with only a short blank space separating them.

Tribute is paid to our international authority on tropical medicine, Colonel Richard P. Strong, M.C., A.U.S., for his encouragement, advice and criticism, indicating that the plan of instruction at the Army Medical School has been followed.

The two volumes are abundantly provided with excellent plates and illustrations and, in particular, illustrations depicting epidemiology, some of which take up approximately a whole page, as in the discussion of Chagas' disease, page 216. However this is probably the best way to impress the mind of the student.

Epidemiology is deservedly emphasized, and other considerations such as pathology and symptomatology have been curtailed. As an old man I regret to see no space given history. History plays a part in making us remember as do illustrations. For instance, in malaria, how valuable it is for one to know that Lav-Ross pointed out, in 1898, mosquito transmission in a malarial blood. At this time the Italian authorities were maintaining a bacterial cause. Grassi, Celli, Bignami and other great Italian researchers, only in 1885 accepted the protozoal origin. Ronald Ross pointed out in 1898, mosquito transmission in a malarial disease of sparrows, and a little later the Italians demonstrated conclusively the transmission of human malaria by anopheline mosquitoes. Such data aid us in orientation but I feel strongly and indignantly that the great curse of nosologic medicine is in giving names of men for diseases, often strung out to include three or even four names for a single disease; the name of an individual may even be attached to more than one disease.

I regret that a chapter was not given to infectious hepatitis, one of the most serious diseases encountered by our troops in the Pacific and elsewhere. It was not until it was found that the factor in yellow fever immunization, responsible for this type of jaundice, rested in certain human sera, that we stifled criticism of this essential immunization. Ash and Lucké have done such splendid research on this disease that their efforts should have been incorporated.

It may be said that this is not a tropical disease; but what is a tropical disease? Le Dantec used for the title of his excellent manual the French for exotic disease. This term should replace tropical medicine, as indicating diseases uncommon in the clinics of London, Paris or New York, but including diseases prevalent in arctic or equatorial regions.

Again emphasizing the recognition of the importance of epidemiology in all transmissible diseases, a great amount of space is devoted to tables and to differentiating characteristics of various helminthologic and entomologic genera and species. For instance there are 6 pages of fine-print tables about anophelines in all parts of the world. There are four pages of chemical control of arthropods, and 12 pages dealing with drug therapy of helminths, this in addition to the paragraphs on treatment of each specific disease. Checking the pages devoted to such data in earlier books on tropical medicine, I note that one of the best of foreign manuals, Martin Mayer's "Exotische Krankheiten," in 1929, excluding ancylostomiasis, filariasis, and schistosomiasis, devotes only 19 pages to helminthology. (E. R. S.)

THE ETIOLOGY, DIAGNOSIS, AND TREATMENT OF AMEBIASIS, by *Charles Franklin Craig, M.D., M.A. (Hon.), F.A.C.S., F.A.C.P., Colonel, United States Army, Retired, D.S.M., Late Commandant, Army Medical School, and Assistant Commandant, Army Medical Center, Washington, D. C. Emeritus Professor of Tropical Medicine, Medical School, Tulane University of Louisiana, New Orleans, La.* 332 pages: illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price \$4.50.

In this book the author has "endeavored to include all of the data of value now available regarding amebiasis." He believes that his presentation should prove of value to the general practitioner, public health officer, and medical officers of the Army, Navy and Public Health Service. There is no doubt that he has accomplished this task and done it well. His life-long interest in amebiasis and his personal investigations of many of the problems this infection has presented have given him the broadest knowledge of the disease that probably anyone possesses.

Its 300 pages make it a rather large book for one confining itself to a single disease. Yet as one reads the various chapters it is difficult to find paragraphs that could have been eliminated without loss of essential information. The text is well classified under the usual headings of definition, etiology, epidemiology, pathology, etc., and the points one may desire are readily found through a good index. Illustrations are well selected but rather scanty.

There is evidence of haste in the writing of this book, with lack of integration of the old and the new. In some instances this will confuse those readers who are not students of amebiasis. An example of this is the discussion of races of *Endamoeba histolytica* and sizes of cysts and trophozoites. On page 12, for example, the reader is given the concepts of two races, while on page 18 the author seems to agree with Dobell that there are at least five races. The picture of the parasite is further blurred by contradictory statements of the size of cysts and trophozoites. On page 11 the size of trophozoites is given as from 15 to 60 microns, while the cysts (page 14) are said to measure from 6 to 20 microns. This is repeated in table 10 on page 216-217, except that the lower limit of trophozoites is set at 18 microns. The small race trophozoites which form the cysts below 10 microns seem to have been forgotten.

In some minor details the author is rather speculative, as in his discussion of the legendary pre-cystic forms of *Endamoeba histolytica* in the cytoplasm of which "refractile oval or rod-like bodies are sometimes present resembling the chromatoid bodies within the cyst and probably identical with such cyst" (page 14).

In discussion of the morphology of *Endamoeba coli* (page 195) it

is stated that its trophozoites "never contain red blood corpuscles," yet on page 210, the author seems to agree with Tyzzer and Geiman that this may occur. Not a few statements are qualified as based on "the writer's experience," and this has resulted in occasional presentation of observations of long ago which have not been confirmed. For example on page 198 it is asserted that in the case of *E. coli*, chromatoidal bodies are "never present in the 8-nucleated cyst in the writer's experience," yet turning back the very leaf of that page reveals a drawing of an *E. coli* cyst with 8 nuclei and 2 very prominent chromatoid bodies.

While these imperfections are relatively minor, they detract significantly from the instructive value of the book, and with regret one concludes that an outstanding and timely opportunity for this country to have the perfect book on amebiasis has been lost.

MEDICAL PARASITOLOGY AND ZOOLOGY, by *Ralph Welty Nauss, B.Sc., M.D., Dr. P.H., Assistant Professor of Public Health and Preventive Medicine, Cornell University Medical College. Foreword by John C. Torrey, Ph.D., Professor (Emeritus) of Epidemiology, Cornell University Medical College.* 534 pages; illustrated. Paul B. Hoeber, Inc., New York, publishers, 1944. Price \$6.

This book is a response to the increasing emphasis placed on medical zoology and parasitology by the present war and the accelerated means of transportation and communication. The author shows the importance of these fields and how he believes they should be integrated into American medical education. The book is a text for beginning students rather than a reference book. In this respect it has a commendable selection of material, so that the amount and type presented approaches that which can be used in the amount of time usually allotted to a course in medical parasitology and zoology.

A section containing 7 chapters is devoted to the parasitic protozoa and the diseases caused by them. For each species there are discussions of morphology, life cycle and pathogenicity, diagnosis, treatment, prognosis, epidemiology, and prophylaxis. The tables and illustrations in this section are well chosen and contribute much to its usefulness.

The second part of the book (3 chapters) is devoted to helminthology, and in general organization is ideal for teaching purposes. In the descriptions and diagrams of the life cycles of the enteric trematodes, the names of the snails are omitted and little is said of their biology and ecology. The filariasis table omits *Wuchereria malayi*, and the relation of *Aedes pseudoscutellaris* to the nonperiodic filariasis is not presented clearly.

The schistosomiasis is treated in a single discussion, with a table for morphologic differentiation and giving intermediate

hosts of the three types; differences in epidemiology and ecology are not indicated. The order of this section is based on the systems of the host infected rather than on the phylogenetic relations of the causative organisms. This is a commendable teaching device.

The third section deals more strictly with medical entomology and is somewhat inferior to the preceding sections, in that there are unfortunate omissions and cases of misplaced emphasis. For example in listing the oriental species of the subgenus *myzomyia* important in transmitting malaria, three of the most important species are omitted. The treatment of *Aedes aegypti* and yellow fever is excellent although perhaps more could have been made of the relation of urban and jungle yellow fever. The chapter on flies, especially the discussion of myiasis, is not a good source of information. No mention is made of myiasis of the nose, mouth and sinuses caused by *Cochliomyia americana*, *Chrysomya bez-ziana*, and *Wohlfahrtia magnifica* which is more frequently fatal than any other type of myiasis. Species of *fannia*, and *Sarcophaga haemorrhoidalis*, the more common producers of myiasis, are omitted. The old confusion between *Cochliomyia macellaria*, an obligate parasite, and *Cochliomyia macellaria*, a facultative parasite, is maintained. The importance and relation of sylvatic plague in the epidemiology of plague is not discussed. *Xenopsylla cheopsis* and *Liponyssus bacoti* are not included among the vectors of endemic typhus.

The section on medical entomology, as well as the preceding section, contains errors in zoologic nomenclature. Although many of these are more or less academic, some detract from the usefulness of the book. Among these are the use of *Anopheles ludlowi*, a harmless freshwater species, for *Anopheles sundaicus*, a dangerous, brackish-water breeding malaria vector; and the use of *blanfordia*, a nonschistosomorphorous snail genus for *katayama*, the most important genus of *Schistosoma japonicum* intermediate hosts. Students may be confused by the use of synonyms or by the placement of the same organism in different genera in different parts of the text (e.g., *Culex fatigans* and *Culex quinque-fasciatus*, *Pediculus humanus corporis* and *Pediculus vestimenti*, *Wuchereria bancrofti* and *Filaria bancrofti*, etc.).

The author inadvertently indicates a subgeneric status for generic synonyms by placing them parenthetically after the accepted generic names such as *Margoropus* (*Boophilus*) *annulatus*. The methods given for control of medically important arthropods are those which were in use at the beginning of the war, some of which have been superseded by more effective measures developed during the course of the war.

The section on poisonous and venomous forms (3 chapters) is a good presentation for use by students. The classification of snakes is not that in current use, although it probably will not be a source of confusion.

Of particular value are the appendixes dealing with the use of the warm stage, care and use of the microscope, pseudomorphs in stools, staining methods, culture methods and collection and preservation of parasitologic material. From the teaching standpoint the author has used a commendable device in placing the phylogenetic classification in the glossary. This glossary also contains several pages of definitions of technical parasitologic and entomologic terms.

In general the usefulness of the book is enhanced by liberal use of tables (mostly original) and figures (including maps). Only four of the 95 figures are previously unpublished. Despite the criticism indicated in this review the generally discreet selection and presentation of material should make this book of use to beginning students. A careful revision, maintaining the same outline and choice of material, with special attention to the nomenclatorial errors and certain shortcomings in the part dealing with medical entomology, would produce an outstanding textbook.

PERSONAL MENTAL HYGIENE, by *Dom Thomas Verner Moore, O.S.B., M.D., Ph.D., Professor of Psychology and Psychiatry, Catholic University of America.* 331 pages. Grune & Stratton, New York, publishers, 1944. Price \$4.

This volume constitutes an attempt to familiarize the reader with the possibility of emotional adjustment and is written by a psychiatrist who is also a Benedictine monk. The author's intention is to give a number of examples "to provide a knowledge of wholesome attitudes of mind, ideals and principles, some of which the reader can take over, make his own and use practically." The first chapter considers the concept of mental hygiene and mental disorders and statistics of their incidence. The author proceeds to discuss the mental hygiene of emotional life in the next chapter and then succeedingly he discusses such subjects as depression, anger, hatred, and race prejudice. Chapter 4 is entitled "Anxiety and Scrupulosity," the latter being a special type of anxiety encountered in religious life.

Throughout the entire work the author skilfully weaves a discussion of various characters of history and literature into the text, and he has drawn upon a wealth of knowledge garnered from diverse subjects to arrive at his conclusions.

The book is not a "self-help" book in the ordinary sense of the word, inasmuch as there is no tendency to exhort the reader, but rather he depends upon philosophic and logical approach.

The last two chapters are concerned with subjects rarely found in any treatise of mental hygiene, namely, "Religious Sublimation" and "Reinterpretation and Religious Ideals." The last chapter is given over largely to an interpretation of the life of Joyce Kilmer.

The philosophic-theologic approach of the author to the problem of mental hygiene will undoubtedly appeal to some people who are unwilling to accept the approach of various other schools. In general the book is well and interestingly written.

AMERICAN MEDICAL PRACTICE IN THE PERSPECTIVES OF A CENTURY, by *Bernhard J. Stern, Ph.D., Lecturer in Sociology, Columbia University; Visiting Professor of Sociology, Yale University*. 156 pages. The Commonwealth Fund, New York, publishers, 1945. Price \$1.50.

This is a study of the social and economic changes which have occurred during the last century in connection with the practice of medicine in America, made under the auspices of the New York Academy of Medicine and from an appropriation of the Commonwealth Fund.

Doctor Stern begins with an excellent description of the general social changes in the United States since 1840 and this is one of the most interesting chapters in the book. He follows this with a parallel description of the most important changes and advances in medicine during the same period and particularly with the development of specialization and its influence upon medical practice.

The remainder of this little book consists of an excellent and scientific study dealing with the distribution of physicians in the United States, the supply of physicians, their income and the patient-load carried by the individual doctor. The distribution of the medical service in America in the various population groups, that is in rural and urban areas, among Negroes and whites, in different geographic sections and as affected by the work and income of patients, is very well described. There is a short appendix on the effect of the recruitment of physicians for the armed services from the supply in civilian areas.

Recommendations or proposals for the improvement of medical service or the solution of many problems involved are not included. The book is intended merely as informative and is one of a series of studies which are perhaps intended to be the basis of recommendations by suitable agencies or medical groups.

SURGERY OF MODERN WARFARE, Volumes I and II, Compiled by 77 contributors and edited by *Hamilton Bailey, F.R.C.S., Surgeon, Royal Northern Hospital, London; Sub-Editor for Medicine, C. Allan Birch, M.D., M.R.C.P., D.C.H., D.P.H., M.M.S.A., Senior Physician, North Middlesex County Hospital*. 3d edition. 1108 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price \$20 per set.

This two-volume work, brought into existence as a result of the

present war, may be considered one of the war's minor blessings. The forthright writing and directness of purpose of the contributors gives one the impression of a breath-taking urgency which has caused them to rush into print with the best available material for the physicians who had overnight been thrust into uniform and into the surgical holocaust of war. Such motivation has resulted in a work which is a veritable storehouse of surgical information.

In the preface to the first edition, the editor, Hamilton Bailey, states that the book "has been written by a team which can claim to represent British Surgery." The surgeons of Britain could do no better than to let that claim stand, for they are very creditably represented, indeed, by 77 illustrious and inspired contributors behind whom is the driving force of a masterful director, guide, and active participant. This is no "armchair" or "name" editor who has lent only the prestige of his name to the work, for the book is Hamilton Bailey throughout.

The result is an example of the multi-contributor text at its best. The coordination of the contributors is seen in the various chapters dealing with wounds, where one finds each contributor on the different systems and parts of the body emphasizing the difference between wound excision and debridement and time factors for each. Throughout there is a similar general agreement on aims, principles, and methods of treatment which betokens a strong central figure, and by the soundness of these betrays the presence of Bailey in the wings.

Also characteristic of a Bailey production is the emphasis placed on practical procedures. Immobilization is not dismissed by such statements as "a plaster cast or traction is applied." There is an entire chapter devoted to "Plaster Technique" and another to "Methods of Applying Extension to Limbs." The chapters entitled "The Use of Braun's Splint and its Modifications" and "The Use of Cramer Wire" also fall into this category; i.e., exceedingly practical and useful. On the other hand physiologic and pathologic considerations are not neglected and are especially provocatively presented in the chapters on "Gas Gangrene," "Frost Bite," and "Trench Foot," despite the latter's somewhat confusing presentation of the role of the phenomena of supercooling in these conditions.

Naval medical officers will recognize with amusement the temporary Lieutenant Royal Navy in Hamilton Bailey speaking when he so loyally and with such engaging frankness proclaims "The Royal Navy (is) always the first of the services to make use of new methods."

Already in its third edition, since July 1941 each succeeding

edition has added the accumulating surgical experience of the war. Having drawn its material from international sources and having an international scope has given the book a large and widespread sale. It is undergoing translation in many languages and has been adopted by the U. S. Army for use of medical department personnel.

Such a reception is richly deserved, for it is a genuine, lasting contribution to the world's surgical literature and should be on the top left hand corner of every medical officer's book shelf.

TEXTBOOK OF SURGICAL TREATMENT, Including Operative Surgery, compiled by 19 contributors; edited by C. F. W. Illingworth, M.D., Ch.M., F.R.C.S.E., *Regius Professor of Surgery, University of Glasgow*. 2nd edition. 564 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price \$9.

This textbook of surgery, as implied by the title, is a volume for the medical student and covers virtually the entire field of surgery in a synoptic form. The material is presented in a clear and logical manner with suitable stress on the basic principles of physiology.

Throughout the text, surgical technic has been given a position subordinate to that of the preparation and postoperative care of the patient, although most of the procedures in common use are adequately considered. The emphasis on treatment of the patient rather than on lengthy descriptions of technical methods and the various modifications thereof lend a readability to the volume which should earn the gratitude of the average senior student.

The revised chapter on burns is especially good and embodies most of the newly accepted fundamentals of burn therapy with sufficient stress given to the importance of body fluid replacement.

The section entitled "Affections of the Thorax" is unusually complete for a work of this scope—even to a description of the technic of phrenicectomy. One cannot but wish, however, in the light of recent war experiences in the treatment of hemothorax, that considerably more discussion of air replacement therapy might have been included.

The British preference for sulfapyridine over other sulfonamide derivatives is quite evident, though less remarkable than the many parallel modes of therapy in use on both sides of the Atlantic.

The illustrations are both modern and purposeful and lend considerably to the appearance and usefulness of the book. There is no bibliography, and the text rather appears to have been written chiefly from the experience and beliefs of the contributors. These criticisms, however, should not detract from the value of the volume as an adjunct to the undergraduate teaching of surgical treatment.

GREEN AND YELLOW CROSS, Special Pathology and Therapy of Injuries Caused by the Chemical War Materials of the Green Cross Group (Phosgene and Diphosgene) and of the Yellow Cross Group (Mustard Gas and Lewisite), by *Hermann Büscher, M.D., Ph.D.* Translated from the German by *Nell Conway, M.A., Kettering Laboratory of Applied Physiology, College of Medicine, University of Cincinnati.* 156 pages; illustrated. Kettering Laboratory of Applied Physiology, University of Cincinnati, Cincinnati, Ohio, publishers, 1944. Price \$4.

Although the method of handling the subject is much broader in scope than is usually seen in works on chemical warfare, there is no lack of detail with regard to features of immediate practical significance in either text or illustration.

There is a definite unusual quality in the author's work and observations. The subject material is presented in a modest, simple manner. The defects are noted by the author, who has a high degree of accuracy in clinical observations. The presentation in its entirety is filled with practical "pearls of wisdom." The reviewer does not recommend this book for the average student in chemical warfare but it should be consulted by those who are specialists in this field.

As in most German publications, a good deal of the chemistry of agents is discussed. The unusual opportunity was afforded the author to care for workmen over a period of years who were employed to clean up an explosion of 48,000 tons of war gas after the cessation of hostilities following World War I. The classification of war gases is very similar to that used today for teaching purposes. Carbon monoxide and hydrogen cyanide (nerve and blood poisons) are also included with tables of interesting data on toxicity, the analysis of which is of practical importance when applied to field work. It is interesting to note that little change has taken place in our approach to this problem aside from the protective phase. The description of the pathology and treatment of phosgene poisoning is excellent, although large strides have been made along the lines of physiology since this book was written. Mention is made of the action of war gases on shells and water. To my knowledge no one has had the author's experiences in treating so large a group of casualties under peacetime conditions.

The author's acuity can readily be observed by the interest taken in the effects of gas on foliage. Although some arguments presented are not generally accepted at present, the subject matter is excellent. The description of the eye pathology is well done. The chemistry of these agents and their reactions is clearly put, so that a beginner in the field should have little difficulty.

The disadvantages of a constricting bandage for mustard burns,

the irritation of chemical ointments, and the problem as to whether to open or leave intact mustard blisters are well discussed.

It is rarely that one individual has the opportunity to follow the clinical course of casualties from war gases in peacetime. Of all employees, 31.17 percent were casualties.

The print is small and the lithography is poor, which makes reading difficult. This presentation makes enjoyable reading for those interested in this subject and emphasizes the fact that the Germans are well versed in chemical warfare.

MODERN OPHTHALMIC LENSES AND OPTICAL GLASS, by *Theo. E. Obrig, A.B., President, Obrig Laboratories, Inc.* 3d edition. 323 pages; illustrated. Obrig Laboratories, Inc., New York, publishers, 1944. Price \$4.50.

The third edition of this volume by one who is well known for his studies and clinical advances in the problems of contact glasses, has been extensively revised to present a prospectus of the field of optical glass, with consideration of its history, manufacture, theory of the nature of light and of lens action, and types of ophthalmic lenses with their indicated uses. It presents categorically all types of ophthalmic lenses available on the market today with all existing variations necessary for special vocations and trades (bifocals, additional segments, trifocals, etc.) and for compensatory corrections (prismatic inclusions, unequal reading-segments, cataract bifocals, etc.). A review of the properties of radiant energy and their effects upon the eye, with a table of absorption figures, is presented for commercial lenses with their common trade names. This is helpful in assessing the relative values of the various colored and tinted lenses available in eliminating excessive or specific elements in sources of radiant energy.

Contact lenses, telescopic spectacles, and iso-iconic lenses are given brief discussions, particularly with regard to the merits of the various models available on the market today, and short descriptions of the scientific principles upon which their construction is based and of the practical problems which arise in their clinical use. The author very modestly includes his advances with the use of the plastic contact glasses in their proper place in the development of this field. The chapter on bifocal and special trifocal and vocation segments is particularly good, giving in considerable completeness the types of bifocals, when they are indicated and how they differ. There are also numerous valuable tables, giving the data for decentration to increase or decrease the prismatic effect of a lens or segment.

This book would be of particular interest to an ophthalmologist, optometrist, or to a manufacturing optician, since it gives clearly

the commercial types of optical glass and lenses, and in brief the indications for the use of the various products with their methods of fitting or application. It is not the intent of this volume to act as a manual of therapy and it does not purport to perform this function.

It is of sufficient interest to warrant issue to ophthalmologists and refractionists who care to study more deeply the medium with which they are working, although it must be realized that the exigencies of war make many of the items discussed in this volume unobtainable on the current market; that the time and effort necessary to perform many of the more detailed studies are not available to the busy Naval medical or refractionist officer; and that many of the subjects to whom these special lenses and devices would be applicable, are, by nature of the specific morbid process requiring this special aid (contact glasses for keratonus, telescopic spectacle for retinitis pigmentosa, cataract bifocals for aphakic patients, etc.), excluded from the service.

INTERNS HANDBOOK, A Guide, Especially in Emergencies, for the Intern and the Physician in General Practice, by Members of the Faculty of the College of Medicine, Syracuse University, Under the Direction of M. S. Dooley, A.B., M.D., Professor of Pharmacology; and Maynard E. Holmes, M.D., F.A.C.P., Professor of Clinical Medicine. 3d edition. 579 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1944. Price \$3.

This book, directed primarily to the intern, proposes to correlate material for clinical application. It contains some valuable material and will be useful during emergency when consultation of a more authoritative work is not expedient. Coordination of subject matter, however, is unfortunate. It seems strange that a section on the endocrines should occupy 55 pages, whereas a chapter on the management of acute abdominal conditions runs to only 8½ pages, 6 of which are devoted to the stomach tube in gastrointestinal diagnosis, constipation, and liver function tests. A chapter on dermatology is wholly inadequate.

This book has little to offer a discerning student of medicine. There are other books similar to this which are undoubtedly superior. Its shortcomings are many.

PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge

WATER SANITATION

II. CHLORINATION OF DRINKING WATER

JOHN C. GEYER

Lieutenant H(S) U.S.N.R.

Recent investigations of chlorination and its control have made possible improved disinfection of drinking water. When chlorine was first used in the purification of municipal water it was thought that there was a fixed dose of chlorine which would disinfect all waters. Early investigations were directed toward discovering this single optimum therapeutic dose. After some years it was shown that sufficient chlorine must be added to supply the chlorine demand of water and to provide a residual which would assure disinfection.

The advantages of residual control were such that the practice of adding fixed chlorine doses fell rapidly into discard. There ensued a period, which may be considered as extending to the present as far as general practice is concerned, during which the chlorine dose was varied and efforts were directed toward determining a fixed residual which would produce satisfactory disinfection under all conditions. Although this change to residual control was a major step forward in the science of water purification, a universally acceptable standard residual could not be decided upon. The bactericidal results obtained were often inconsistent and the taste and odor problems were in some cases accentuated by chlorination.

Attention gradually turned to solution of the taste and odor difficulties resulting from the addition of chlorine. It was found that with the usual doses of chlorine the "iodoform" tastes and odors were not due to the presence of free chlorine but rather to the chlorine reaction compounds produced when the water contained heavy algal growths or certain types of industrial wastes (notably phenols). Two methods of combating the taste difficulty were discovered.

¹ This is the second of a series presenting information on various phases of water sanitation. Part I, Water Quality Standards, appeared in the April 1945 issue of the BULLETIN.

The first and most widely used method was ammonia-chlorine treatment. The formation of odorous compounds was prevented by adding first a small amount of ammonia and then the chlorine. Chloramines formed in place of the objectionable reaction products. The usual ratios of chlorine to ammonia-nitrogen ranged from 4:1 up to 8:1. It was realized that chloramines are slower acting disinfectants than free chlorine but it was generally held that their lasting qualities offset this disadvantage.

The second method of chlorine odor control was superchlorination-dechlorination. This process developed when it was found that chlorinous odors produced at ordinary doses could often be destroyed by adding large amounts of chlorine and subsequently dechlorinating the water.

The continued occurrence of unexplained variations in disinfection, chlorine demand, and taste control, stimulated in recent years research in which the variables were carefully measured or controlled. These investigations have thrown light on:

- (a) The relative ineffectiveness of chloramines.
- (b) The complexity of the situations which may arise when ammonium ion is present in or is added to water prior to chlorination.
- (c) The great importance of hydrogen ion concentration.
- (d) The nature of the chlorine reaction and ionization products responsible for disinfection and their method of action.

Discoveries in connection with the last item resulted primarily from research carried on at Harvard University and at Columbia University under the sponsorship of the National Research Council with grants from the Office of Scientific Research and Development. Though the results are not available for publication there is some possibility that as a result of this work there may be a trend toward control of chlorination to provide the necessary amounts of true disinfecting reaction products needed to accomplish a particular job.

Chlorination thus affords another example of a technical process which, having been considered well-developed and understood for some years, is suddenly thrown open to review by the findings of orderly research. A review of available information should reduce the differences in opinion which exist with regard to what constitutes a safe residual and as to the need for carrying residuals throughout water distribution systems.

SUMMARY OF DEVELOPMENTS

The following recent discoveries and developments should result in major improvements in the disinfection of drinking water.

1. Biochemic tests under laboratory conditions indicate that free chlorine is a far more powerful disinfecting agent than chloramines. These tests indicate that in order to accomplish the same degree of bactericidal action the ratios of residuals and contact times must be somewhat as follows:

(a) For equal concentrations of residuals, chloramines require 20 to 100 times as long as free chlorine to give 100-percent kill.

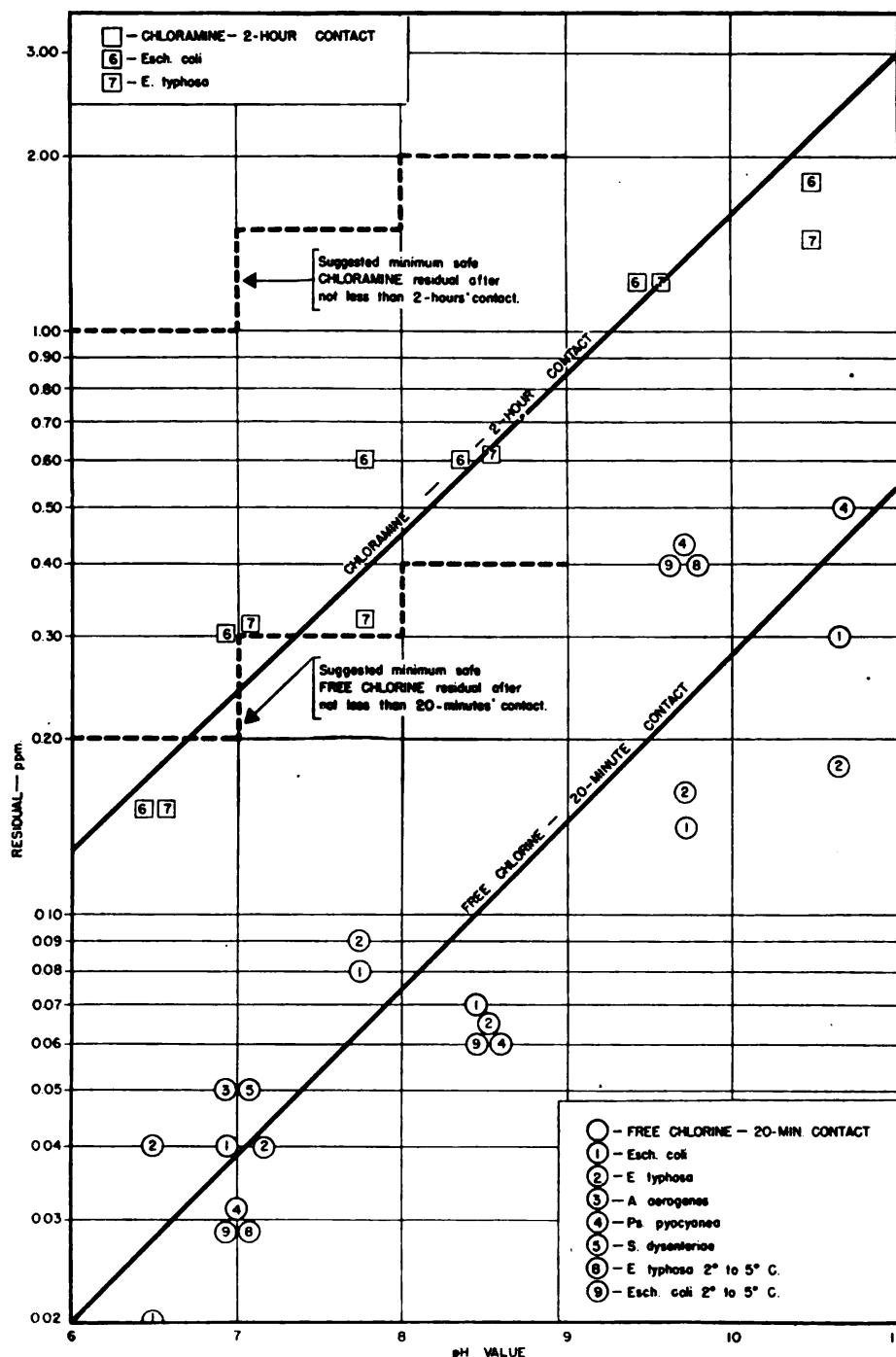
(b) For equal contact periods the chloramine residuals must be 20 to 40 times as great as free chlorine residuals to obtain the same results.

(c) Comparing the two at the commonly specified contact times, the 2-hour residual chloramine must be more than 5 times the 20-minute residual free chlorine to produce 100-percent kill of ordinary intestinal forms of bacteria.

2. Although the findings enumerated above have not yet been confirmed by plant scale tests using natural waters, it is apparent that *chloramine* residuals should be distinguished from *free chlorine* residuals. The practice of referring to "residual chlorine" without differentiating between free chlorine and chloramine probably accounts for much of the confusion and difference of opinion as to results obtainable and ought therefore to be completely abandoned.

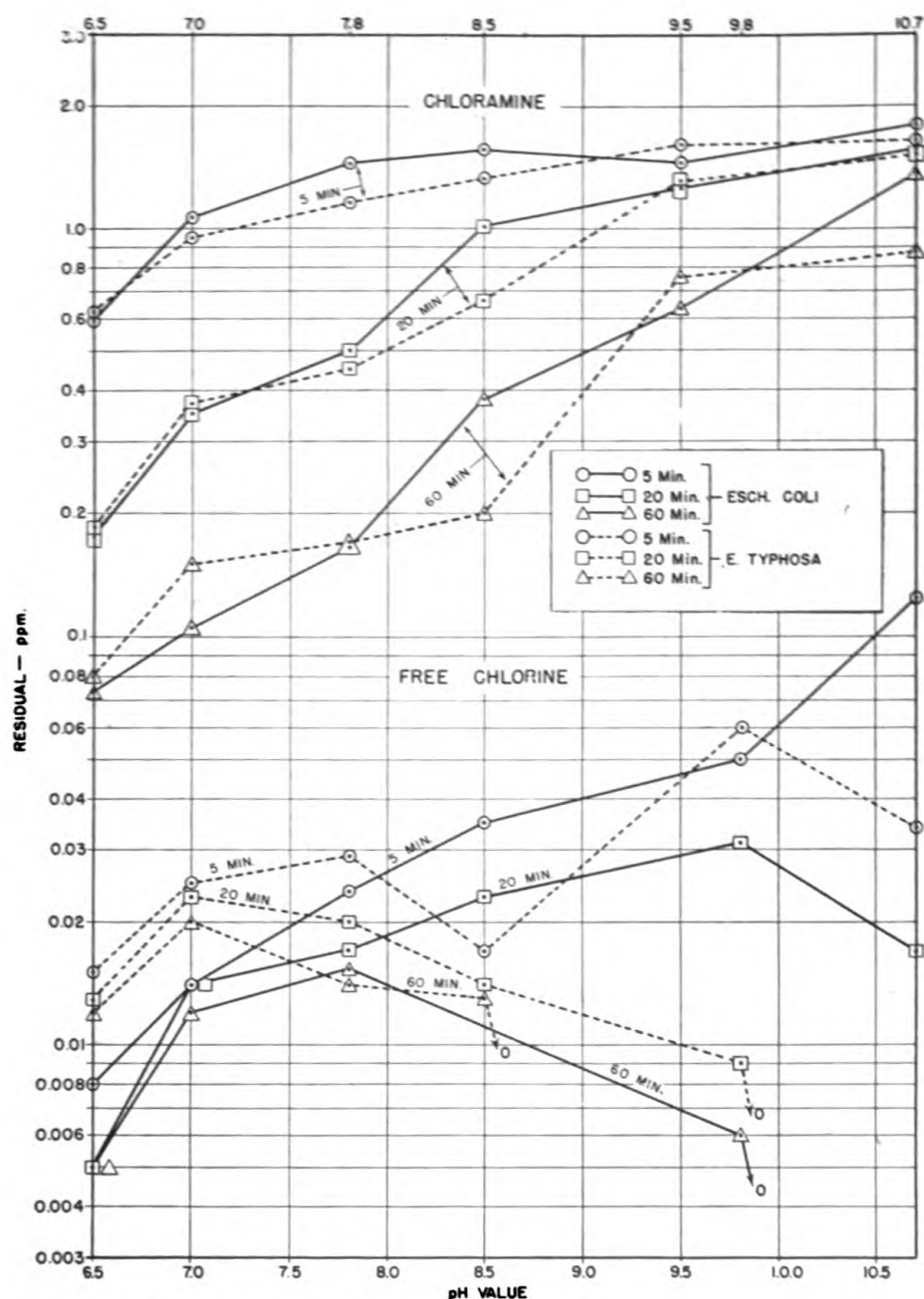
3. The ortho-tolidine test as ordinarily used does not distinguish between chloramine and free chlorine residuals. The discovery that chloramines are relatively weak and ineffective disinfecting agents has placed great emphasis on the need for a rapid and simple test to measure quantitatively each type of residual. Several satisfactory tests have been developed of which the ortho-tolidine flash test, and the ortho-tolidine-arsenite (OTA) test appear to be the most practical for field use.

4. It has been known for some time that low temperature and low hydrogen ion concentration (high pH values) reduced the disinfecting power of both free chlorine and chloramine. However the actual extent of this reduction has received only recently the attention it merits. Carefully conducted biologic tests indicate that both the free chlorine residual and the chloramine residual required for thorough disinfection may under some conditions increase in a geometric progression with pH value. For example at room temperatures each unit increase in pH appears about to double the 20-minute free chlorine and the 2-hour chloramine residual required for 100-percent kill. The effect of pH on the ionization of hypochlorous acid (HOCl), the reaction product now considered principally responsible for disinfection, and the direct effect of pH on bacteria are probably two of the more important



1. Comparison of free chlorine and chloramine residuals for 100-percent kill of intestinal bacteria at various pH values.

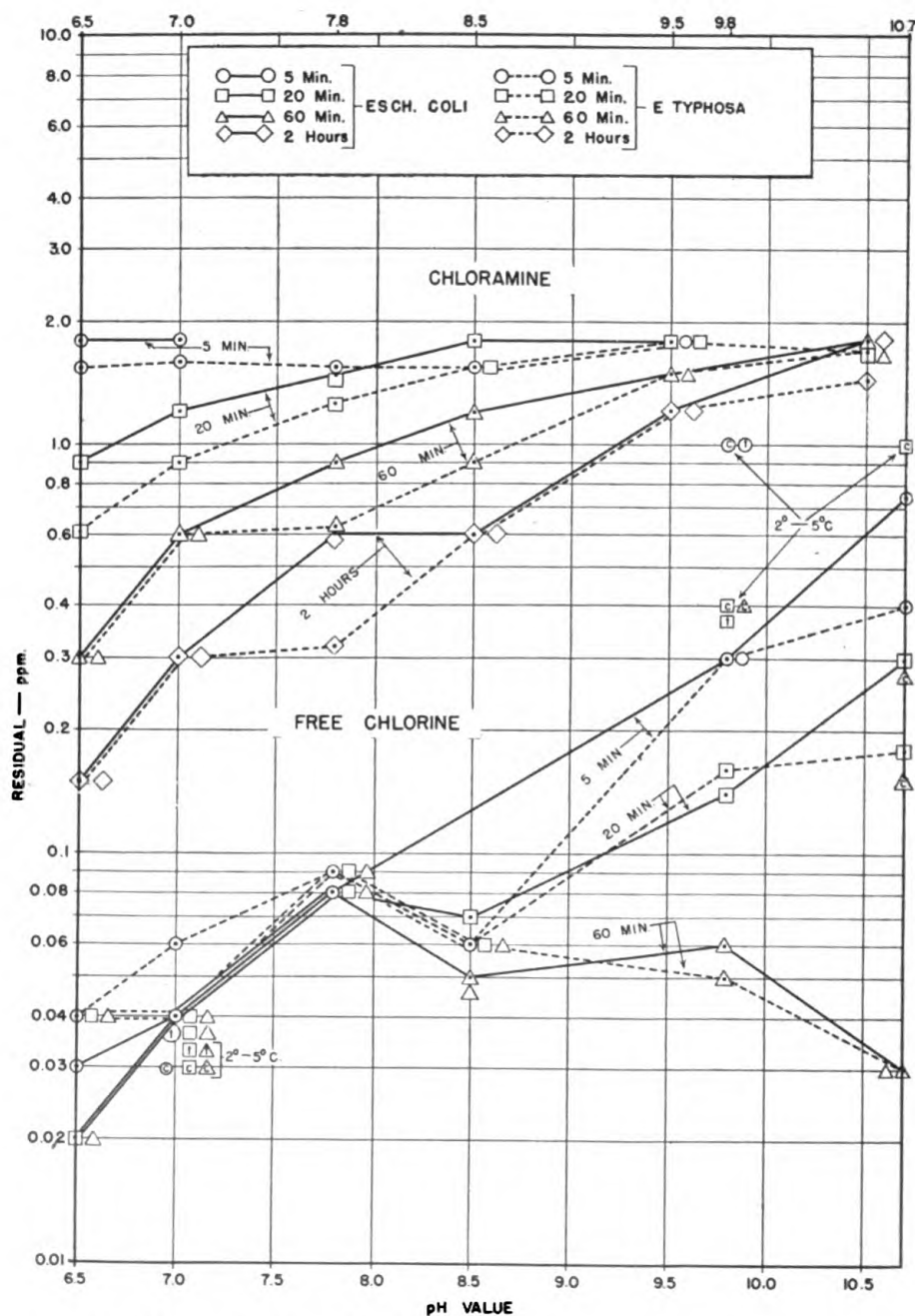
factors which cause the residual requirement to vary with pH. In any event the effect of pH is so striking that it is advisable to take it into account when disinfecting water. The effect of temperature has been less well studied but in the ordinary pH range appears to be less dramatic than that of hydrogen ion concentra-



2. Residuals required to give 100-percent kill in various contact times.

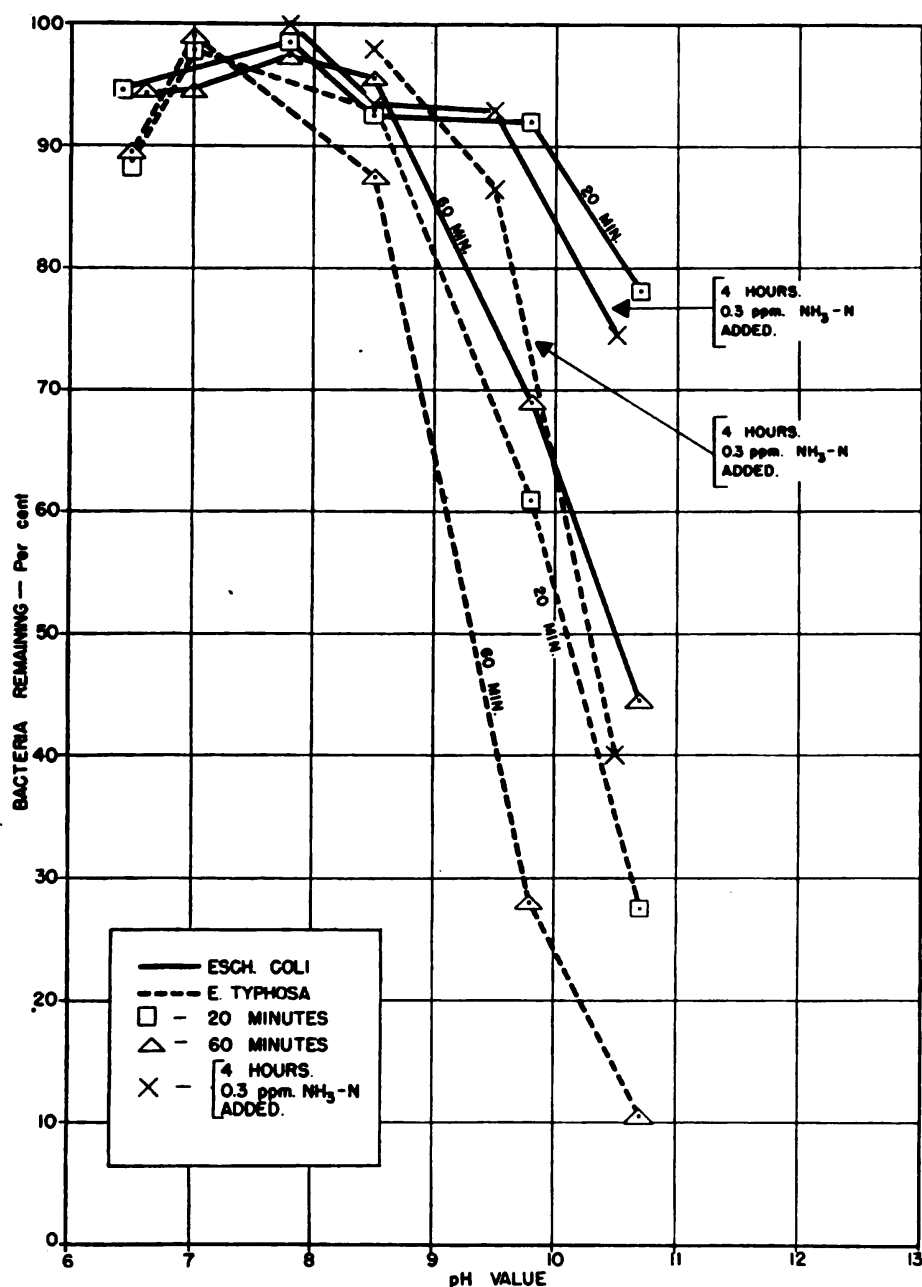
tion. Residuals suggested in the full discussion of this subject are believed to be adequate at temperatures close to freezing.

5. It has been established that in pure dilute solutions of ammonia, increasing doses of chlorine up to about five times the amount of ammonia-nitrogen present results in the formation of chloramines. Additional chlorine destroys the chloramines until at a chlorine dose of about nine times the original ammonia-nitrogen all the chloramines have disappeared and the total ortho-tolidine residual is reduced to zero. Beyond this point (called the



3. Residuals required to give 50-percent kill in various contact times.

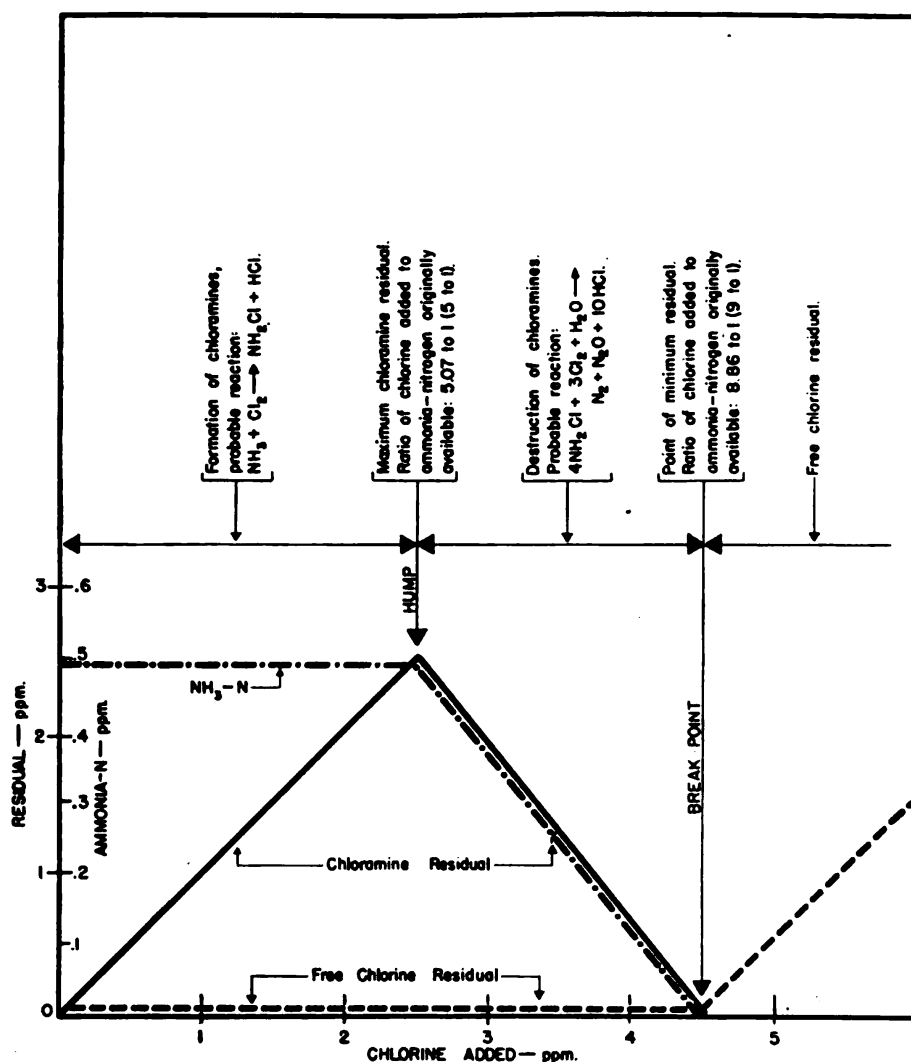
breakpoint) free chlorine begins to appear. In natural water the presence of other chlorine-reacting substances complicates the situation in ways that are not understood. However chlorination to the point that from 85 to 100 percent of the total residual is free chlorine is believed to carry natural waters past the breakpoint. Experience has shown that breakpoint chlorination (chlorination past the breakpoint) will generally produce water that is free of organisms which ferment lactose broth.



4. Survival of *Escherichia coli* and *Eberthella typhosa* in USPHS chlorine-demand-free water buffered at various pH values.

BACTERIAL EFFICIENCY OF CHLORINE AND CHLORAMINES

The excellent studies conducted at the Stream Pollution Investigations Laboratory of the United States Public Health Service (1) (2) have made available for the first time data from which reliable conclusions may be drawn concerning the bactericidal efficiency of free chlorine and chloramines and the effect of pH value upon these efficiencies. Practically all earlier bactericidal studies failed to produce consistent and reliable information,



5. Theoretic residual curve in presence of 0.5 ppm of ammonia-nitrogen.

either because no distinction was made between free chlorine and chloramines, or because attempts to produce essentially chlorine-demand-free suspensions of bacteria were not successful.

Special technics (1) were used to produce buffered chlorine-demand-free water for use in the United States Public Health Service tests. A bacterial population of 2,000 per ml. was selected as convenient and representative of natural waters that might serve as water supply sources. It was found that bacteria in this density exerted a negligible chlorine demand. The percent kills for various times and residuals were measured at pH 6.5, 7, 7.8, 8.5, 9.8, and 10.7. Most of the tests were conducted at room temperature (20° to 25° C.), and the balance at near freezing (2° to 5° C.). In the chloramine studies 0.3 ppm of ammonia-nitrogen (ammonia expressed as N) was added to sterile chlorine-demand-

TABLE 1.—Average percent survival of various bacteria when exposed to FREE CHLORINE in various concentrations at pH7 and 20° to 25° C.

No. of strains	No. of tests	Average percent surviving after an exposure of								Average free chlorine: ppm after an exposure of		
		1 min.	3 min.	5 min.	15 min.	30 min.	60 min.	90 min.	120 min.	0 min.	60 min.	120 min.
		Escherichia coli										
2	3	98.6			100.0	96.6	94.8	97.5	96.8	0.00		0.00
2	4	29.1	16.2	19.4	17.7	18.6	19.4		15.6	0.02	0.02	Tr.
2	4	16.1	0.8	0.8	0.3	0.2	0.8	0.1	0.1	0.03	0.02	0.01
1	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.04	0.03	0.02
2	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.05	0.04	0.03
2	3	0.0	0.0	0.0	0.0	0.0	0.0			0.07	0.06	
2	2	0.0	0.0	0.0	0.0	0.0	0.0			0.10	0.10	
		Eberthella typhosa										
2	5	100.0			96.2	98.4	99.0	96.9	96.6	0.00	0.00	0.00
2	6	82.7	77.6	72.3	64.7	61.0	48.4	49.3	41.1	0.02		0.01
2	4	71.0	33.8	27.2	23.6	25.0	22.0	19.0	13.5	0.03		0.02
2	5	16.8	1.3	0.1	0.0	0.0	0.0	0.0	0.0	0.04		0.04
2	4	8.9	6.9	4.8	1.1	0.1	0.0	0.0	0.0	0.05		0.04
2	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.06	0.06	0.06
2	5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.08	0.07	0.07
1	1	0.0	0.0	0.0	0.0	0.0	0.0			0.15	0.13	
		Aerobacter aerogenes										
2	4	100.0			95.5	96.7	97.7	96.3	97.3	0.00	0.00	0.00
2	4	82.8	85.4	79.4	80.2	72.1	77.5	77.0	67.9	0.02	0.02	0.01
1	2	93.2	80.2	70.8	56.9	51.2	46.9	34.1	21.5	0.03		0.02
2	4	62.3	38.7	32.4	31.6	27.8	21.5	19.0	10.0	0.04	0.03	0.03
1	2	57.6	1.4	0.2	0.0	0.0	0.0	0.0	0.0	0.05		0.04
2	3	14.5	0.4	0.6	0.4	0.4	0.1	0.0	0.0	0.06	0.05	0.05
2	2	0.0	0.0	0.0	0.0	0.0	0.0			0.08	0.08	0.07
2	6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.12	0.12	0.08
		Pseudomonas pyocyanea										
2	4	100.0			97.1	96.3	95.4	95.4	88.6	0.00	0.00	0.00
2	10	79.1	63.9	47.6	43.1	43.0	40.6	37.7	32.2	0.01	0.01	Tr.
2	3	40.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.02	0.02
2	2	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.04	0.03	0.03
2	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.05	0.04	0.04
2	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.06	0.05	0.05
		Shigella dysenteriae										
3	5	100.0			98.9	90.5	94.4	83.2	84.4	0.00	0.00	0.00
3	5	85.7	76.6	75.1	67.4	56.4	28.7	30.5	22.4	0.01		0.01
3	4	50.6	27.6	25.7	22.2	23.2	17.0	10.8	4.3	0.03		0.03
3	5	51.9	23.9	15.6	9.5	4.8	0.1	0.1	0.0	0.04		0.04
3	4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.05	0.05	0.04
3	3	13.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.06	0.06	0.05
3	3	1.0	0.0	0.0	0.0	0.0	0.0			0.08	0.08	

free water to produce chlorine to ammonia-nitrogen ratios of 0:1, 1/2:1, 1:1, 2:1, 3:1, 4:1, 5:1, and 6:1 when standardized chlorine solution was added.

The results of tests at pH 7 and 20° to 25° C. are reproduced in tables 1 and 2.

Study of the results shown in these tables indicates that the ratios of effectiveness, stated in item 1 under "Summary of De-

TABLE 2.—Average percent survival of *Escherichia coli* and *Eberthella typhosa* when exposed to CHLORAMINES in various concentrations at pH7 and 20° to 25° C.

No. of strains	No. of tests	Average percent surviving after an exposure of											Chloramines ppm 0 min.	Cl ₂ /N ratio
		1 min.	3 min.	5 min.	10 min.	20 min.	40 min.	60 min.	90 min.	120 min.	180 min.	240 min.		
		Escherichia coli												
2	4	100.0	.....	.....	.....	97.6	100.0	100.0	.....	86.6	100.0	77.4	0.01	0-1
1	2	97.3	.....	76.6	82.6	69.8	54.4	25.2	.....	0.1	.....	.....	0.15	1/2-1
2	4	99.0	.....	81.7	76.4	59.6	4.4	0.1	0.0	0.0	.....	.....	0.30	1-1
2	4	92.4	.....	72.8	60.2	4.2	0.0	0.0	0.0	0.0	.....	.....	0.60	2-1
2	4	96.2	85.9	58.2	23.5	0.4	0.0	0.0	0.0	0.0	.....	.....	0.90	3-1
2	4	78.4	61.0	41.2	3.2	0.0	0.0	0.0	0.0	.....	.....	.....	1.20	4-1
2	4	72.1	52.5	17.8	0.2	0.0	0.0	0.0	0.0	.....	.....	.....	1.50	5-1
1	2	86.6	15.4	0.0	0.0	0.0	0.0	0.0	.....	.....	.....	.....	1.80	6-1
		Eberthella typhosa												
2	4	100.0	.....	.....	.....	.....	.....	.....	.....	.....	97.8	.....	Tr.	0-1
2	4	95.6	.....	.....	.....	93.7	67.3	49.9	27.4	30.6	3.4	0.6	0.15	1/2-1
2	4	95.4	.....	83.1	77.4	62.6	13.4	1.3	0.0	0.0	0.0	.....	0.31	1-1
2	4	88.6	.....	79.1	58.0	5.7	0.0	0.0	0.0	0.0	.....	.....	0.60	2-1
2	4	75.5	66.8	53.9	9.0	0.0	0.0	0.0	.....	.....	.....	.....	0.90	3-1
2	4	63.6	43.3	23.2	0.3	0.0	0.0	0.0	.....	.....	.....	.....	1.10	4-1
2	4	46.4	22.0	1.4	0.0	0.0	0.0	0.0	.....	.....	.....	.....	1.45	5-1
2	4	20.6	0.2	0.0	0.0	0.0	0.0	0.0	.....	.....	.....	.....	1.60	6-1

velopments," are in general correct. For example, 0.03 to 0.06 ppm free chlorine residual was required for 100-percent kill in 20 minutes, while a chloramine residual of about 0.3 ppm was required for 100-percent kill in 2 hours; thus the statement that the 2-hour chloramine residual should be more than five times the 20-minute free chlorine residual for 100-percent kill.

Since 20 minutes for free chlorine and 2 hours for chloramines are the most commonly specified contact times, the dose required for 100-percent kill at these contacts have been taken from the original tables (1) (2) for plotting residual against pH in figure 1. All the plotted points are for room temperatures 20° to 25° C., unless otherwise noted on the diagram. The vertical spread in the points at each pH is due in part to the wide intervals between the residuals tested in the ranges that were critical for the particular contact times plotted. For example, at pH 9.8 the test residual was jumped from around 0.15 to 0.40 in what may be considered the critical range of doses for 20-minute contact. Since no tests were made at residuals between 0.15 and 0.40 ppm, the points fell at one or the other of the two values.

Lines drawn to show the general trend of the plotted points indicate a ratio between the 2-hour chloramine residual and the 20-minute free chlorine residual for 100-percent kill of about 6:1. The tendency of the points to group along straight and parallel lines on semilog paper occurs only for the particular contact times plotted in figure 1.

Thorough analysis of the USPHS test results requires a review of the published data and charts (1) (2). Figures 2, 3, and 4 have been prepared from the original data to assist those interested in such an analysis. The following points appear to be established but presumably should be considered as strictly applicable only to the conditions of these tests.

1. The free chlorine residual required in the lower part of the pH range studied is independent of contact time while the residual required at high pH varies widely with contact time because the hydroxyl ion exerts a slow bactericidal action in the high pH range.

2. With chloramine disinfection the above situation is reversed. At high pH the chloramine residual approaches the same limiting value for all contact times.

3. *Eberthella typhosa* is more resistant to free chlorine than *Escherichia coli* at neutral pH.

4. In the absence of chlorine, *Eberthella typhosa* is less resistant to high pH than *Escherichia coli* (fig. 4).

5. In the absence of chlorine the addition of ammonia-nitrogen greatly increases the survival time of both *Escherichia coli* and *Eberthella typhosa* at high pH values (fig. 4).

6. At pH values around 7 to 8, low temperatures do not increase the free chlorine requirements, but at high pH values the free chlorine requirements are greatly increased by lowering the temperature.

Any attempt to explain these things should take into account:

- (a) Chemical and ion concentrations at each pH.
- (b) Reaction velocities.
- (c) Bactericidal effect of each chemical and ion in the complex.
- (d) Growth inhibiting or promoting characteristics of the environment apart from the action of disinfectants.
- (e) Variations in strains of organisms tested.

Explanation of the observed phenomena is made difficult if not impossible by the lack of information on some of these points. It appears, therefore, that caution should be used in applying conclusions to the much more highly complex situations encountered in natural waters.

It is believed that the most important fact brought out by the USPHS tests is the remarkable difference between the disinfecting power of free chlorine and of chloramines. That this difference holds for natural waters is supported to some extent by the results obtained when breakpoint chlorination is used. It is assumed in the following section that in regard to differences in the effectiveness of free chlorine and chloramines the findings of the

USPHS study are sufficiently applicable to natural waters and plant scale operations to serve as the basis for suggesting rules for the control of water chlorination.

RESIDUAL CONTROL OF DISINFECTION

A factor of safety must be used when selecting safe residuals in order to allow for the things which may cause the residual to vary. Normal variations in the chlorine demand of the water, variations in flow, accuracy of the feeding method, quality of operation, frequency of residual tests, and other factors determine the variability of the treated water residual. In suggesting control residuals it is assumed that the factor of safety should be 2 to 3 or more and should be greater at low residuals than at higher ones because of the relatively greater effect of variations.

The following suggested rules for control of chlorination are based on the data plotted in figure 1, with allowance of reasonable safety factors. The selection has been influenced to a considerable extent by an attempt to stay within the range of residuals which experience has shown give reasonably satisfactory results.

1. In order to assure the destruction of bacteria and at the same time keep objectionable tastes at a minimum, it is necessary to differentiate by test between *free chlorine* and *chloramine* residuals. If this differentiation is not made, the safest course is to assume that chloramines are present and to use high doses and long contact periods.

2. If the residual is *free chlorine* and the pH is below 7 the chlorinator should be set to give not less than 0.2 ppm free chlorine residual after the chlorine has been in contact with the water for 20 minutes or more. Increase this residual 0.1 ppm for each increasing unit pH interval above pH 7, i.e., for pH 7 to 8 use 0.3 ppm free chlorine residual, and for pH 8 to 9 use 0.4 ppm free chlorine residual. Measure the pH at the time the residual is measured, not before chlorination.² Operate purification plants to maintain the pH below a value of nine.

3. If the residual is *chloramine* and the pH is below 7 the chlorinator should be set to give not less than 1 ppm chloramine residual after a contact period of 2 hours or more. Increase this residual 0.5 ppm for each increasing unit pH interval above pH 7, i.e., for pH values between 7 and 8 use 1.5 ppm chloramine

² Since chlorine interferes with color development in the pH test, samples must be dechlorinated before adding the indicator dye. This may be done by adding a grain of sodium thiosulfate or a drop or two of sodium thiosulfate solution. Sodium thiosulfate will have only slight effect upon the pH, provided the solution used is not preserved with sodium hydroxide. One drop of 0.025 N standard sodium thiosulfate solution (6.205 gm/l, $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$) added to the 15-ml. sample in a commercial comparator vial will reduce about 3 ppm of chlorine.

residual and for pH values between 8 and 9 use 2 ppm chloramine residual. Operate purification plants to maintain the pH below nine.

The residuals suggested above are shown by the heavy dotted lines in figure 1.

The interval from the lower free chlorine residual of 0.2 ppm to the upper chloramine residual of 2 ppm about covers the range of various residuals that have been adopted as safe for field practice. However these limiting residuals have for the most part been used without regard for pH values or for the type of residual present. Thus it is quite conceivable that under present conditions the 0.2-ppm residual rule is being applied where the pH is above 8 and the residuals are chloramines, while at places where a 1-ppm residual rule is applied the pH may be below 7 and the residual free chlorine. With this state of affairs erratic results with regard to both disinfection and taste of the treated water might be expected to occur from time to time. Experience seems to indicate that such is the case.

The limiting chloramine residuals have been selected almost wholly on the basis of laboratory findings. Since they represent a considerable departure from accepted practice, the need for maintaining the suggested chloramine residuals should be considered as being subject to demonstration by experience in plants where free chlorine and chloramines are distinguished.

It is generally agreed that chlorine is equally effective when added as a gas or in the form of a chlorine compound such as Grade A calcium hypochlorite, provided, of course, that other factors involved remain constant. Large doses of hypochlorite may, however, raise the pH of water sufficiently to affect the killing power of the chlorine. Therefore when hypochlorites are used it may be better in some cases to add an acid to lower the pH than to use excessively high chlorine doses.

The killing power of free chlorine and chloramines at the recommended residuals and at pH 7 may be noted as to contact time by study of tables 1 and 2. Under conditions of the tests a free chlorine residual of 0.2 ppm appears to be about twice the amount needed to give 100-percent kill in 1 minute, while a chloramine residual of 1 ppm is just about enough to give 100-percent kill in 20 to 30 minutes. Thus from the viewpoint of contact times it appears that the factor of safety using the recommended free chlorine residuals is much larger than that obtained when the recommended chloramine residuals are used. This should not be interpreted as justifying reduction in the contact periods but rather as a factor favoring the use of free chlorine disinfection.

The true control contact period in any plant is the time required for passage of the water from the point of chlorination to the point of sampling for the residual test. If a fixed sampling point is used this contact period will vary inversely with the rate of flow through the plant and the system. Furthermore when the necessary contact period is provided by passage of the treated water through basins or reservoirs it is not the theoretic detention period but rather the actual flow-through period that determines the contact time. Although these seem to be obvious facts they are not always taken into account.

Sampling near the point of chlorination and holding the sample for the required contact time before testing for residual is probably a poor substitute for allowing proper contact time in the system before collecting the sample. In order to obtain adequate contact time before the water reaches the first consumer when using chloramine disinfection, it is generally necessary to add the chlorine ahead of the filter plant or ahead of a flow-through reservoir (not one floating on the line) from which the distribution system is fed. Adequate contact for chloramines can be provided in pipe lines only when the length of line between the point of chlorination and the first consumer is of the order of 1 to 3 miles. To be exact a flow distance of 7,200 feet is required for 2-hour contact when the velocity is 1 foot per second. Higher velocities require correspondingly greater lengths of pipe line.

In order to avoid added complications the preceding discussion has been confined to control of chlorination by maintaining a minimum residual after a minimum contact time. Four additional methods of chlorination or of chlorine dose control are in use:

(a) Breakpoint chlorination.

(b) Chlorination to maintain residuals throughout the distribution system.

(c) Superchlorination-dechlorination.

(d) Fixed-dose chlorination without residual control.

Method (c) is widely used for Lyster bag treatment by the military services. The method never has been used extensively in municipal type plants and is now being replaced to some extent by method (a). Both (c) and (d) are used for disinfection of water in canteens and other small containers. Only methods (a) and (b) are subsequently discussed.

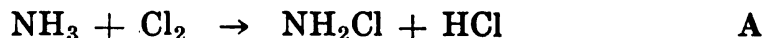
THE FORMATION AND DESTRUCTION OF CHLORAMINES

Studies of the formation and destruction of chloramines under controlled laboratory conditions have thrown considerable light on the situations encountered when chlorine is used for water

disinfection in purification plants. The work of Moore, Megregian, and Ruchhoft (3) produced sufficiently consistent results to provide the basis for a hypothesis concerning the chemical reactions involved. Their curves showing measured residuals for various chlorine doses at fixed ammonia contents were essentially the same for pH values ranging from 6 to 9 and for contact times from 1 to 24 hours. An idealized curve is shown in figure 2.

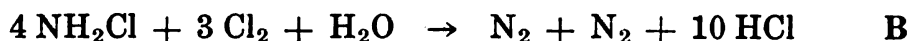
When chlorine is added to water containing ammonia-nitrogen, chloramine residuals increase in direct proportion to the amount of chlorine until a chlorine:ammonia-nitrogen ratio of 5:1 is reached. Beyond this point the chloramine residual decreases toward zero which is reached at a chlorine:ammonia-nitrogen ratio of about 9:1. Chlorine added beyond this point appears as free chlorine.

The fact that the hump in the residual curve occurs when the chlorine:ammonia-nitrogen ratio is about 5:1 is believed to indicate that the reaction between chlorine and ammonia must produce monochloramine according to the equation:



for which the theoretic chlorine:ammonia-nitrogen ratio is 5.07:1.

Assuming that the monochloramine is oxidized in accordance with the reaction:



the chlorine required to carry the residual from the "hump" to the "breakpoint" would be 3.79:1 when the ratio is based on the original ammonia-nitrogen content. Therefore the breakpoint should come at a chlorine:ammonia-nitrogen ratio of

$$5.07 + 3.79:1 \quad \text{or} \quad 8.86:1.$$

The observed mean ratio at the breakpoint was 9:1.

There exists considerable difference of opinion concerning the validity of equation B. The manner in which chloramine is oxidized should, therefore, be considered an open question.

There may actually be several combinations of reactions involved in both the formation and destruction of chloramine. An approximation of the actual situation which exists in the solution at equilibrium can be obtained only if the ionization constants for all the possible ion combinations are known.

The following pertinent information may be deduced from the diagrammatic curve in figure 2.

1. Relatively small amounts of ammonia-nitrogen are required

to convert into chloramines the amounts of chlorine ordinarily added to water.

2. The residual may approach zero when the chlorine dose is about nine times the ammonia-nitrogen present even though the amount of chlorine added is relatively large.

3. The highly effective disinfecting agent free chlorine does not appear in a stable form until the 9:1 chlorine:ammonia-nitrogen ratio is exceeded.

4. Small variations in ammonia-nitrogen content of water may cause great variations in the amount and sometimes the type of residual present.

5. In the presence of ammonia the chlorine demand, which is the difference between the chlorine dose and the total measured residual, is an erratically varying quantity.

In connection with item 5, for idealized conditions of figure 2 the chlorine demand is zero for chlorine doses of 2.5 ppm or less. For chlorine doses increasing from 2.5 to 4.5 ppm the chlorine demand increases from zero to 4.5 ppm. The demand then remains constant with further increases in chlorine dose. If a variable ammonia content (approximating natural conditions) is assumed the variations in chlorine demand can become quite complex.

Item 4 also merits elaboration. Since free chlorine is many times as effective as chloramines, variations in the ammonia-nitrogen may under certain conditions have a tremendous effect upon the degree of disinfection obtained with a given dose of chlorine. Consider, for example, the theoretic effect of increases in ammonia content if 5 ppm of chlorine were added to obtain about 0.5 ppm free chlorine residual when the ammonia-nitrogen content is exactly 0.5 ppm. An increase in the ammonia content to 0.56 ppm would reduce the chlorine:ammonia-nitrogen ratio to 8.9:1 and all residual would disappear. Further increase in the ammonia content would result in increasing chloramine residuals as the chlorine:ammonia-nitrogen moved back to 5:1. At this ratio, i.e., when the ammonia-nitrogen content reaches 1 ppm, the chloramines would have reached a maximum of 5 ppm and would remain constant during further increases in ammonia.

Thus with a fixed chlorine dose of 5 ppm the residual varies from 0.5 ppm free chlorine to zero at the breakpoint to 5 ppm chloramine at the hump as the ammonia increases from 0.5 ppm to 1 ppm. It appears, therefore, that the variability of the ammonia content is a highly important matter when the chlorine:ammonia-nitrogen ratios are in the vicinity of the breakpoint. The fact that a small increase in ammonia may sometimes change

a free chlorine residual to a chloramine residual emphasizes the importance of determining the type of residual when making routine control tests.

The phenomenon of chloramine formation and destruction as described above applies specifically to pure dilute solutions of ammonia. The behavior of residuals when chlorine is added to natural water containing complex organic and mineral constituents does not follow, although it may approach, the theoretic curve.

BREAKPOINT CHLORINATION

In water purification practice the addition of sufficient chlorine to destroy chloramines and provide a residual which is 85 to 100-percent free chlorine is called breakpoint chlorination. Griffin (4) summarizes the practice of breakpoint chlorination as follows:

The chlorine requirement for breakpoint chlorination, i. e., the quantity of chlorine required to obtain free chlorine residuals, is a function of the ammonia and nitrogenous content of the water. When 30 to 40 ppm chlorine are required the water will usually have an ammonia content of approximately 3 to 4 ppm. Normal requirements of 2 to 8 ppm chlorine have been accompanied by an ammonia content of 0.1 to 0.5 ppm. Although 0.05 is the smallest amount of ammonia that will produce a characteristic breakpoint curve, waters seldom are so completely devoid of ammonia as not to require treatment with sufficient chlorine to destroy ammonia and produce a free chlorine residual.

The practice of adding ammonia to induce a breakpoint should not be resorted to except when abnormal conditions exist. The process has been used very successfully in certain isolated instances where ordinary breakpoint practice has not completely eliminated the tastes and odors or where the chlorine demand has been unduly variable. Such cases usually have been limited to those supplies where the natural ammonia content of the water has been very low or where the ammonia has fluctuated rapidly and over a wide range. When this form of breakpoint chlorination is used seldom more than 0.25 ppm of ammonia need be added.

The "characteristic breakpoint curve" referred to in the first paragraph quoted is a residual curve which shows a discernible hump and depression. The so-called characteristic curve may resemble but certainly differs materially from the idealized curve of figure 2. The residual curves obtained when increasing amounts of chlorine are added vary widely with different types of natural waters. The hump may be completely absent, and with some types of water, free chlorine apparently may appear along with considerable amounts of chloramine. What actually takes place is not understood. A few complicating factors are:

1. False residual due to iron, manganese, and nitrite may be interpreted as chloramine. This difficulty can be overcome by use of the OTA test described later.

2. Chlorine reacts with constituents other than ammonia to form chlorine-addition products. Whether or not such products have disinfecting power and the extent to which they may affect the residual reading does not seem to be understood.

3. Since chloramines form slowly under some conditions, the possibility exists that residuals may be measured before reactions are complete. In this connection still unreacted free chlorine is presumably available for rapid disinfection. This no doubt confuses the picture as to the type and degree of disinfection occurring when chloramine treatment is used. This is particularly true at pH values below 7, in which range from 20 to 30 minutes is believed to be necessary for completion of the reaction.

The term "chlorine demand" as used in the second paragraph quoted probably refers specifically to the free chlorine demand for breakpoint chlorination. If so, substitution of "breakpoint chlorine demand" would avoid confusion with the ordinary use of the term chlorine demand. As stated earlier, chlorine demand (the difference between the dose and the total residual at any point along the residual curve) is a highly variable quantity in the presence of ammonia.

It is interesting to note in the second quoted paragraph the conditions under which the addition of ammonia is considered necessary, i.e., where the natural ammonia content of the water is very low or where the ammonia has fluctuated rapidly and over a wide range. These two conditions are essentially the same for the reason that with a very low ammonia content even slight variations in its amount would produce relatively wide fluctuations in the chlorine:ammonia-nitrogen ratio. It is the latter ratio which is important when working in the vicinity of the breakpoint. Thus when fluctuations in ammonia content produce difficulties, which are probably of the type anticipated above under the discussion of theoretic considerations, it is necessary to reduce the relative variation by adding a uniform dose of ammonia. Otherwise it may be too difficult to stay on the right side of the breakpoint without overchlorinating.

When using breakpoint chlorination in a water treatment plant it is not necessary to determine the residual curve. Breakpoint chlorination may be controlled by meeting the two following requirements:

(a) Maintain a residual which is from 85- to 100-percent free chlorine.

(b) Maintain this residual above the minimum necessary to assure complete disinfection.

The doses needed to meet requirement (a) may produce resid-

uals which are considerably in excess of those needed to meet requirement (b).

Where used on a plant scale, breakpoint chlorination has resulted in remarkable reductions in the lactose-fermenting organisms. In fact it appears practical to produce with this method a water that is consistently free of lactose fermenters. When breakpoint chlorination is first tried in any plant a 1- or 2-month period may be expected to elapse before positive presumptive tests completely disappear. There are two reasons for this:

(a) Experience with the method is required for good control.

(b) Where subbreakpoint chlorination has been used there may be an accumulated chlorine demand in the system which must be supplied before free chlorine will persist.

As an example of the improvement in disinfection resulting from the introduction of the breakpoint chlorination, one of the cases reported by Griffin and Chamberlin (5) is reviewed below.

In this case water from a reservoir into which a small amount of domestic waste discharged was treated by coagulation, sedimentation, filtration, and disinfection. During the 2½ years prior to breakpoint chlorination, chloramine disinfection was used. During this period 9.4 percent of all 10-ml. lactose tubes planted on the finished water sampled at laboratory tap showed gas formation. Breakpoint chlorination was introduced and the process controlled to maintain a free chlorine residual throughout the plant and into the distribution system. During the first 2½ years of breakpoint chlorination not a single 10-ml. portion of the finished water, sampled at the same point, produced gas.

The effect of chlorination upon tastes and odors is not well understood. Chlorine will both produce and destroy objectionable tastes. In the case of chloramine treatment, which developed primarily because it reduced taste and odor problems, the chlorine probably reacts preferentially with the ammonia. Thus the addition of ammonia ahead of the chlorine serves as a taste preventive measure. Unfortunately it appears that it may also prevent rapid and thorough disinfection. Superchlorination-dechlorination on the other hand is a process whereby tastes and odors are burned out by use of high chlorine residuals which are subsequently removed by adding a dechlorinating agent. Breakpoint chlorination evidently effects a similar reduction in tastes but since the free chlorine residual is controlled, dechlorination is usually unnecessary. Whether or not any one of these three methods of disinfection will improve the taste of a particular water can be determined only by trying it. Although they all have worked in many cases, there have also been notable failures. The latter are

attributed to the difficult nature of the taste- and odor-producing compounds in the water, but may also be partly attributable to improper use and control of the particular method.

With regard to the advantages of breakpoint chlorination Griffin (4) states:

The direct benefits of Breakpoint Chlorination include superior bacteriological removal; taste and odor reduction; coagulation improvement; iron and manganese oxidation; algae control; and color bleaching. Indirect benefits include improved water quality, particularly in the distribution system; maintenance of pipe line capacity; inhibition of biological corrosion; and betterment of "red" and "black-water" difficulties.

Of these, the benefits of improved water quality due to improved disinfection are by far the most important. Other benefits may accrue in some instances but should be considered largely ancillary.

It may be impracticable to apply breakpoint chlorination in the military type portable water purification plants if ammonium alum is used, because of the ammonia added as part of the coagulant. Ammonium alum contains 3.1 percent ammonium radical expressed as nitrogen. With the usual field dose of coagulant of 4 grains per gallon (70 ppm) or more, the amount of ammonia added is at least 2 ppm. Assuming all of this ammonia is available for reaction with the chlorine, a dose of 20 ppm or more of chlorine might be required to reach the breakpoint. What happens to the above ammonia during coagulation, sedimentation and filtration is not known. If it is reduced in amount during these processes breakpoint chlorination of the filter effluent may be feasible. At best, however, control would be difficult because of the variability in ammonia content resulting from the uncertain control of coagulant dose in portable military water purification equipment.

RESIDUALS IN THE DISTRIBUTION SYSTEM

Opinions differ on the question of whether or not chlorine residuals should be maintained throughout a water distribution system. Those who favor the practice claim:

(a) That residuals in the mains remedy to some extent the bacterial contamination which results from faulty sterilization of new or repaired mains.

(b) That the presence of residual chlorine in the distribution system gives protection against contamination due to cross-connections and back-siphonage.

Those who question the need for maintaining residuals throughout the system say:

(a) That the practice is at best a poor substitute for thorough sterilization of new or repaired mains and equipment.

(b) That contaminated water entering the system through cross-connections or by back-siphonage will displace the chlorinated water rather than mix with it, so that only when the leakage into the system is relatively small will any protection be obtained.

(c) That in order to carry residuals, chloramine disinfection must ordinarily be used and as chloramines act very slowly the protection against recontamination is unreliable.

(d) That thorough sterilization of the system, the elimination or control of cross-connections and proper disinfection of the water entering the system are necessary and will provide a safe water.

The question of whether or not residuals should be carried in the distribution system is confused by the failure to distinguish between free chlorine residuals and chloramine residuals. If chloramine residuals of the order suggested herein are used, i.e., one or more ppm residual is maintained after a 2-hour contact period, residual in some amount is very apt to appear throughout all active parts of the system.

It has often been found that maintenance of residuals in a system corrects excessive coli-aerogenes densities in water sampled from outlying mains. This suggests the possibility that the residual may have been chloramine and that the water entering the system may not have been thoroughly disinfected at the plant until an attempt was made to hold residuals in the system.

It is believed that the value of maintaining residuals throughout distribution systems cannot be finally determined until it becomes common practice to differentiate between free chlorine residuals and chloramine residuals. If this distinction is made it should be possible to assure proper disinfection of the water entering the system. With the uncertainty on the latter point removed, the value of further increases in chlorine dose to maintain residuals in distant parts of the system may be evaluated.

The information in the last three columns of table 1 may have significance relative to the question of maintaining free chlorine residuals. With chlorine-demand-free water the decrease in the free chlorine residual after 2-hour contact was in most cases 0.01 ppm or less. This suggests that if the full free chlorine demand of the water and of the system could be supplied it might not be difficult to maintain free chlorine in a distribution system. Tests now being conducted by the U. S. Army and others indicate that this is probably true. Because of the accumulated chlorine demand a long period of heavy chlorination may be required before free chlorine residuals can be obtained in distant parts of an old distribution system.

DETERMINATION OF FREE CHLORINE AND CHLORAMINE RESIDUALS

Griffin (4) describes the various methods which have been developed for distinguishing between free chlorine and chloramine residuals. Of the tests now available it is believed that the Laux flash-point test and the Hallinan ortho-tolidine-arsenite (OTA) test are most suitable for controlling chlorination. Hallinan (6) gives full details of the OTA test and Gilcreas and Hallinan (7) report on a survey of water plant chlorination practices in New York State using the OTA test.

Flash test.—The Laux flash test is an adaptation of the ortho-tolidine test in which emphasis is placed on the speed of color production following addition of ortho-tolidine. Color readings are made 10 seconds after the addition of ortho-tolidine and again at the end of 5 minutes. Free chlorine is measured by the initial reading, and the total residual including free chlorine, chloramines and interfering substances by the 5-minute reading. The test is most sensitive at lower temperatures but is readily discernible at 60° Fahrenheit. At 100° F. the difference in speed of color development is barely readable.

OTA test.—The ortho-tolidine-arsenite test measures the interfering substances (false residual) as well as the free chlorine and chloramine. In order to make the test there are needed in addition to an ordinary comparator a 5-gm. per liter solution of sodium arsenite, two extra 15-ml. comparator cells, and an extra dropper. The procedure is as follows:

1. Using four cells of a commercial comparator, mark one OT, one A, one B, and one C.
2. Fill all cells to the mark with sample so collected as to allow the desired chlorination contact period. Warm OT cell to about 20° C. if very cold.
3. To OT cell add dropperful of ortho-tolidine and mix by one quick shake.
4. To cell A first add dropperful of ortho-tolidine. Mix. Within 10 seconds add a dropperful of arsenite solution. Mix.
5. To cell B first add dropperful of arsenite solution. Mix. Then a dropperful of ortho-tolidine. Mix.
6. Place cell A in the reading position and cell B back of the color standard and read. This reading will represent the *free chlorine* residual, and interfering colors will have been taken care of automatically.
7. Five minutes after treating OT cell place it in the reading position. Leave cell B back of the color standard and read. The difference between the reading of cell OT and cell A will represent the *chloramine* residual, with interfering colors eliminated.

8. Place cell B in the reading position and cell C back of the color standard and read. The reading represents the false residual.

If desired, cell C may be placed back of the color standard and cells A, B, and OT read individually after 5-minute contact. The readings will then represent the following:

A=Free chlorine plus false residual.

B=False residual.

OT=Total residual (free chlorine, chloramine and false).

From which the computations should be:

A minus B=Free chlorine.

OT minus A=Chloramine.

Griffin suggests that step 6 immediately follow step 5 and that 1 ml. of ortho-tolidine and 0.5 ml. of arsenite solution be used where these chemicals are called for. When making a series of tests care must be taken to avoid mixing the droppers and to be sure that the cells are thoroughly flushed between tests.

SUMMARY

Evidence that free chlorine is a much more powerful bactericidal agent than chloramine has been reviewed. On the basis of this evidence it is believed that in order to obtain satisfactory disinfection either free chlorine residuals and chloramine residuals must be distinguished, or high total residuals must be used on the assumption that chloramines predominate. Two test methods are given for differentiating free chlorine and chloramine residuals.

Hydrogen ion content has a marked effect upon the bactericidal effect of both free chlorine and chloramine. It is thought that this should be taken into account in controlling residuals.

The following minimum requirements for residual control are suggested:

1. Differentiate free chlorine and chloramine residuals.
2. If the residual is free chlorine and pH is below 7, chlorinate to obtain 0.2 ppm free chlorine residual after 20-minute contact. Increase this residual 0.1 ppm for each increasing pH interval above seven. Maintain pH below nine.
3. If the residual is chloramine and pH is below 7, chlorinate to obtain 1 ppm chloramine residual after 2-hour contact. Increase this residual 0.5 ppm for each increasing pH interval above seven. Maintain pH below nine.

Consideration of the phenomena of chloramine formation and destruction indicates that relatively small amounts of ammonia

will convert the ordinary amounts of chlorine used into chloramines and that small variations in the ammonia content of water under certain conditions will cause great variations in the amount and, sometimes, the type of residual present.

The practice of chlorinating to the point that chloramines are destroyed and a predominately free chlorine residual is maintained is called breakpoint chlorination. The process can be controlled by adding the minimum amount of chlorine which will produce a residual that is from 85- to 100-percent free chlorine but which in any case must be greater than the minimum safe residual suggested above. Experience indicates that water consistently free of lactose-fermenting organisms may be produced by use of breakpoint chlorination.

It appears that the question of whether or not residuals should be maintained throughout a water distribution system cannot be answered until chlorination is so controlled that it is known with some degree of certainty that the water is thoroughly disinfected when it enters the system.

The developments discussed here are in no part the work of the author. They are believed, however, to be of such fundamental and widespread importance as to justify this review attempted in the interest of better control of the chlorination of drinking water.

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UNITED STATES NAVAL MEDICAL BULLETIN



PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY

VOLUME 45

NUMBER 4



OCTOBER 1945

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED 112



COVER PHOTOGRAPH

Eighty-three years ago the U.S.S. *Red Rover*, a converted river packet captured from the Confederates, steamed up the Mississippi, the first floating hospital ship to serve the Navy. Today 12 sleek ships, some almost 2 blocks in length, fulfill the mission of providing hospital service for the fleet.

Symbols of Navy medical progress, these ships contain the most modern developments that engineering and medical sciences can provide. Their many functions and missions of mercy have won for them the gratitude of the whole Navy. To them also can aptly be applied the citation: "Never in the field of human conflict was so much owed by so many to so few."

—*Official U. S. Navy Photos.*

VOL. 45

OCTOBER 1945

NO. 4

UNITED STATES
NAVAL
MEDICAL
BULLETIN



MONTHLY

DIVISION OF PUBLICATIONS
BUREAU OF MEDICINE AND SURGERY

Compiled and published under the authority of
Naval Appropriation Act for fiscal year 1946,
Public Law No. 62, approved May 29, 1945

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1945

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
See page II for prices

NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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Volume 17, 1922, Nos. 4 and 6.

Volume 18, 1923, Nos. 1, 2, 3 and 5.

Volume 19, 1923, Nos. 2 and 3.

Volume 20, 1924, Nos. 2, 5 and 6.

Volume 24, 1926, Nos. 1, 2 and 4.

Volume 25, 1927, Nos. 1 and 4.

Volume 26, 1928, Nos. 1, 3 and 4.

Volume 27, 1929, No. 4.

Volume 28, 1930, No. 1.

Volume 31, 1933, No. 3.

Volume 42, 1944, No. 2.

SUBSCRIPTION PRICE OF THE BULLETIN

Subscriptions should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Yearly subscription, \$4; foreign subscription, \$5.

Single number, domestic, 35 cents; foreign, 45 cents, which includes foreign postage.

Exchange of publications will be extended to medical scientific organizations, societies, laboratories, and journals. Communications on this subject should be addressed to the Surgeon General, United States Navy, Washington 25, D. C.

PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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NOTICE TO CONTRIBUTORS

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Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

The editors are not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

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U. S. NAVAL MEDICAL BULLETIN

VOL. 45

OCTOBER 1945

No. 4

SPECIAL ARTICLES

TREATMENT OF COMBAT FATIGUE IN A FORWARD-AREA HOSPITAL

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Recent publications (1) (2) (3) have described specific technics for the treatment of combat fatigue, such as hypnosis, intravenous sodium pentothal combined with narcosynthesis, and modified insulin therapy. These diverse methods have apparently all been about equally successful, which fact has aroused the speculation that some more fundamental factor common to all has at least in part been responsible for the therapeutic successes achieved. In this article yet another form of therapy will be described and an attempt will be made to account for the similar results attained by these divergent methods.

The neuropsychiatric department of this forward-area hospital has during the recent Pacific campaigns received a number of combat casualties, the majority diagnosed as combat fatigue. Of these, 80 percent have been returned to duty. The majority of these patients were young Marines, some with considerable previous battle experience, others relatively recently overseas.

Our criteria for "Fatigue, combat" were rather strict. Any patient who gave a past history with more than mild psychoneurotic traits was excluded from this study, and only those were considered who had been well adjusted socially and free of psychoneurotic tendencies.

Upon admission these men presented the rather uniform clinical picture which has been frequently described. In our opinion these presenting symptoms may be roughly divided into two general groups: (1) *Symptoms of anxiety*, either frankly manifested in conscious fear, nightmares, startle reaction, weight loss, tremors, irritability, restlessness, insomnia, tachycardia, and/or anxiety exhibited in transient conversion phenomena such as amnesia, paralyses, or aphonia; and (2) *socio-psychologic symptoms*, such as feelings of shame because of fear, guilt for having failed one's comrades, feelings of dissatisfaction with the service, with the war and the conduct of the war, feelings of inferiority and inadequacy, homesickness, and a marked preoccupation with the family, particularly parents, who are often thought to be sick.

The emotional dislocation responsible for the enumerated socio-psychologic symptoms, is also responsible, we believe, for a change in the patient's general attitude. Crispell (4), from a study of 500 men, has described the following attitude as being typical, with which we fully agree . . . He is "quite upset by his experiences, he did not want any more battles for awhile—perhaps never again; if some more battles had to be fought, then somebody else ought to fight them; he thought that he ought to go home right away." Depending upon the particular individual, the symptoms of one group would be more marked than the symptoms of the other; in some the anxiety features predominate, in others guilt and dissatisfaction are the outstanding findings. But in every one of the patients, symptoms of the two general groups were present to a pathologic degree.

Except for a few patients, this was the first hospital reached following evacuation from the combat zone; in a great majority less than 10 days had elapsed between evacuation from the beach-head and hospitalization here. While enroute, because of excellent care, many of the anxiety symptoms had considerably abated, but it is our impression that in not a few patients the socio-psychologic symptoms had become enhanced.

It seemed to us, after a few of these men had been studied, that the concept of combat fatigue had a twofold connotation, and that the admission symptoms as described above bore this out. As the diagnosis literally carries, these men were tired and were tired of combat; that is, they had been subjected to almost constant danger of injury and destruction, had worked hard physically, had had minimum rest and food, and had lived under extremely primitive conditions. These factors may well be the ones responsible, at least in part, for the anxiety manifestations.

On the other hand, combat fatigue appeared also to involve a more subtle, yet quite definite socio-psychologic feature. These men had been emotionally sustained and morally encouraged by their membership in a group, that is, their unit or outfit, but concurrently with the onset of combat fatigue came an altered relationship to this group. With a change in this relationship the man quickly ceased being an efficient combatant and became instead an isolated, frightened, homesick individual deprived of his up-to-then sustaining emotional ties with his group. His attitude toward the group underwent a marked change in that he became critical and fed up with his companions, he felt he was through with the service, and he desired to return, literally and psychologically, to earlier, more protective and emotionally more sustaining persons, such as parents and others at home.

The treatment of combat fatigue involves not only evacuation from combat, rest, cleanliness, adequate nutrition, and medical care, but also a psychologic re-orientation toward the group of which the man had been a member until the time of his illness. The relief from anxiety and all its concomitants is to a certain extent attained by the mere physical facts of removal from the combat area, hospitalization and proper physical care. For the psychologic re-orientation, a special program had to be evolved.

In order to re-awaken in the patient the feeling of belonging to a group and the desire to remain within the same, we deliberately fostered a group spirit within the neuropsychiatric department as a whole. This was accomplished by encouraging a general therapeutic intent in the staff personnel, particularly the hospital corpsmen and nurses. The general objective of the department—return to duty of patients—was repeatedly emphasized to the point of its becoming axiomatic.

Lectures covering the elementary aspects of psychiatry were given by the neuropsychiatric medical officers. Corpsmen and nurses were specifically indoctrinated and encouraged to maintain an optimistic attitude toward the patients. A general atmosphere was built up in which it was taken for granted that the patients would return to duty after a relatively brief period of hospitalization. The department was able to arrange an active recreational program to which a psychiatrically trained chief pharmacist's mate was assigned, and in which staff members participated freely. An active occupational therapy program was also instituted, and through joint efforts of all staff members a fully equipped workshop was gradually assembled, in which patients and staff members alike spent much time under informal circumstances.

The patient is absorbed into an actively functioning, well integrated group, with which he can identify himself providing his general physical condition permits. We have found that as soon as the patient becomes an active and participating member of the local group, so to speak, the psychologic re-orientation will carry through and he will himself express his desire to return to his own former outfit. These are the general features of the program which has gradually been evolved.

Upon admission, the neuropsychiatric combat casualties are greeted and briefly interviewed by the head of the department, who at that time roughly segregates the patients into (1) the recoverable, combat fatigue cases which as far as possible go to a special ward, and (2) the chronic, psychoneurotic and psychotic types (a minority), who as early as possible are segregated from the recoverables. Physical examinations and brief neuropsychiatric evaluations are completed within 24 hours after admission so that treatment for all minor physical ailments can be immediately instituted, requests for consultations with other services made, and perhaps most importantly, so that the patient from the start is made to feel that the regaining of his health is the primary concern of all. Brief lectures explaining the general organization of the ward and the duties and privileges of patients are given by the ward medical officer during the first few days.

During the first 24 hours the patients may remain in or on their beds at will, but subsequently no patient may lie on his bunk during the day unless specifically permitted by his medical officer. The reason for this rule is explained to the patients, who themselves soon realize that little sleep may be expected at night if the day hours are spent on or in bed. The patients are urged to participate in the quite active recreational program, such as baseball, volleyball, badminton and swimming parties. Those who for physical and/or psychologic reasons do not feel up to active participation are nevertheless urged to accompany the group as spectators.

Every effort is made to make the patients comfortable, but certain duties are assigned them from the start. With the hospital corpsmen and under the supervision of the nurse they are responsible for the cleanliness and orderliness of their own beds, lockers, and the ward as a whole. A general atmosphere of friendliness is deliberately built up on the ward by the staff, without loss of necessary discipline and military courtesy. Sick call, for example, is made with the patients at attention, but during sick call each patient is given full opportunity to talk over his symptoms.

The daily ward-routine is organized along the following lines:

0530—Reveille.
0545—Every patient polices his bunk, locker and immediate area.
0630—Breakfast.
0730—Sick call.
0800—Ward details.
0900—Ward closed to patients who go for games, to workshop, work in garden, Red Cross building, or to assigned places within hospital compound.
1100—Return to ward; clean up for noon meal.
1130—Chow.
1230—Rest period on ward.
1330—Ward closed for 2 hours, same activities as at 0900, with addition of swimming parties twice weekly.
1530—Return to ward; clean up for evening meal.
1700—Chow.
1800—Rest and free period.
1900—Sick call.
1930—Movies, general hospital entertainments.
2130—Lights out.

With few exceptions, the patients take their meals in the general mess hall after the first week in the hospital. Whenever meals are served on the ward, the patients eat in a group at a large table at one end of the ward; a sheet serves as tablecloth and attractiveness and cleanliness are encouraged. Patients wait upon themselves and clean their dishes in rotation. Corpsmen occasionally join the patients at their table. Smoking on the ward is restricted to this one end; smoking on or near the bunks is not allowed. As far as possible, a homelike atmosphere is created; by the same token each patient is expected to treat and consider the ward as his temporary home. Visits by patients from other hospital departments are not encouraged; such contacts are made to a sufficient degree in the general mess hall.

The workshop building is a 16- by 16- by 10-foot standard Marine tent erected immediately adjacent to one of the neuropsychiatric wards and so arranged that access to it is gained only through the department entrance. Its deck is made of scrap lumber; along two walls are solid work benches with vises. Over and under the benches are shelves and lockers for tool storage. The shop is surprisingly light, cool and well ventilated; from 10 to 12 patients are accommodated without crowding.

No tool is hospital issue; thus the hospital maintenance department is not deprived of any implements and has no claims upon the shop. The tools have been gradually procured from other outfits as they move out from this area, some were surveyed as worn out and have been repaired by ourselves, others are not

properly tools but improvizations of utility. Power tools have not been procurable but would be highly desirable. A remarkable variety of objects may be fashioned in wood, metal, and plexiglass by the use of a file, saw, plane, and a few drills. The shop is for the exclusive use of neuropsychiatric patients and staff.

A third activity centers around the grounds between the neuropsychiatric buildings. Here a rock garden has been laid, and plants, bushes, orchids and palm sprouts have been transplanted. Shop-made chairs and benches and pingpong tables are placed around the grounds. In one corner a vegetable garden has been planted, the produce of which is zealously guarded by all.

During his first 10 days of hospitalization, each patient is thoroughly examined by a psychiatrist. Explanations and reassurance are given during the anamnesis, and with suitable patients additional psychotherapeutic sessions are held, singly or in groups of three to four. All are encouraged to come to the psychiatrist with any problems.

For relief of anxiety, methods have been used as varied as the personalities of the patients. For some, hypnosis has uncovered areas of amnesia and other conversion manifestations; for others, intravenous sodium pentothal and hypno-analysis have had beneficial cathartic effect; for yet others, sedatives by mouth have been sufficient. For some patients, cold sheet packs have been of equal if not greater benefit than chemical sedation. Men greatly underweight with poor appetites have been given insulin up to 60 units daily in order to stimulate the appetite.

We have, however, gained the impression that for the alleviation of the acute anxiety symptoms no one method is superior to another; the treatment of these must be determined by the needs of the patient. As a rule medicaments are used as little as possible and it is clearly explained to both patients and hospital corpsmen that the sooner one can do without drugs the sooner one will be well. In general the symptoms of fatigue and anxiety which properly are a part of combat fatigue, have been found to disappear within about 2 weeks under the treatment outlined above.

The psychologic re-orientation, which we believe is equally necessary for recovery, is attempted also from the day of admission. By being encouraged to participate in sports in which corpsmen, nurses and doctors already actively participate, the patients soon feel a comradeship and before long teams and tournaments develop. It is remarkable to observe how quickly a disgruntled and dissatisfied patient will take an interest in a competitive sport, if he is properly approached.

In the same way the workshop provides a variety of opportuni-

ties for making things for one's self, in conjunction with a larger group. In this shop "basket weaving" is discouraged but realistic objects are encouraged, especially those of a warlike nature. Thus 105-mm. shell casings are made into ash trays, models of P-38s, hinges and corner fittings for sea chests, etc.; enemy trophies are repaired and polished; native hardwoods are carved; and bits of aluminum and plexiglass from junked planes become identification disks and watch bands. Each patient keeps as his own that which he makes in the shop. As long as the staff as a whole participates in and maintains an enthusiastic attitude toward the shop activities, the patients will soon enter in and as it were "join the group." It is important that the shop be maintained as a therapeutic means and its facilities restricted to this purpose at all times.

Once the anxiety symptoms have been relieved, and the identification with the department "group" has been made, it is gratifying to observe how smoothly and spontaneously the membership feeling for the original unit or outfit returns. Within 2 to 3 weeks, many of the men spontaneously express a desire to rejoin their outfits, i.e., return to duty; with others it is only necessary for the medical officer to point out that the patient's life has become as active and productive as prior to his illness, and he sees the point of returning to his activity.

It must be noted that these patients upon discharge from this hospital have rejoined their outfits but have not directly returned to combat, as the particular campaigns from which they were evacuated were already over by the time of their hospital discharge. It has, however, been made clear to the patients that by rejoining their old combatant unit they necessarily and automatically soon come in line for further combat duty.

An active recreational and occupational therapy program such as described, in itself has a direct benefit in building up a man's self-confidence and creative ability. A game such as baseball has a reassuring effect on a man's self-confidence especially when well played before an audience; it supplies means of discharging pent-up aggressions through the physical activities involved and through the continuous banter that passes back and forth. The revival of old skills and the learning of new ones in the shop, visibly embodied in the finished product for all to behold, give to most men a healthy glow of self-satisfaction.

We feel, however, that in addition such a program is distinctly of therapeutic benefit because it is a group activity. Thirdly, and perhaps of major importance, the morale of the staff, particularly that of the hospital corpsmen, remains high when they actively

partake in the building up and maintenance of such a program; and as the corpsmen have the most frequent contacts with the patients, high morale among the former will effect the same in the latter group. During the first few months we were in operation and before plans had been formulated and materialized, the return-to-duty percentage of combat fatigue patients was strikingly lower than that subsequently achieved. The growth and expansion of the whole therapeutic program has been paralleled by a steady rise in recovery rate.

We are highly appreciative of and admire the recreational, occupational, and morale-building work of the American Red Cross. Many of our patients have availed themselves of their hospitable facilities. We do feel, however, that the combat fatigue patients require in addition a recreational and occupational set-up which has been deliberately infused with a specific therapeutic intent; such a program is for obvious reasons outside the scope of the American Red Cross.

About 4 weeks is the optimum time of hospitalization here. At the end of this time the patients should feel physically well, should have gained weight, should be free of overt anxiety and should desire to be back with their former comrades. Whereas few patients could stand to see a war movie at time of admission, they should now be able to view the same with relative objective detachment. As an experiment, several patients were kept an additional month; no additional benefits were observed from the prolonged stay. For patients of this type to remain longer than 4 or 5 weeks only prepares the soil for the growth of "hospitalitis."

The combat fatigue patients who did not return to duty from here were evacuated to the rear for further treatment and disposition. Their further course is not known to us. They had in general a more traumatic childhood history than those who recovered; had a higher incidence of broken homes, of paternal alcoholism, of parental desertion or death. Several had been childhood stutterers who after combat suffered exacerbations which were not sufficiently allayed while here to warrant return to duty.

These men were all somewhat improved, but either their anxiety symptoms persisted despite all treatment, or their feelings of guilt, depression and attitude of "being through," remained to such an extent that we did not feel justified in returning them to their outfits. They were transferred from here with the diagnosis of Fatigue, combat, as past history revealed no more evidence of precombat neuroses than shown by the men who did recover.

Finally the local geography and topography must be given consideration and due credit. By being treated here, the men

remained in an area close to and essentially similar to the combat area, but free of its dangers. The physical environment here reminded them as little of "home" as it did on the scene of combat. By being evacuated to this area the patient is in no sense nearer "home" than he was while with his outfit—as a matter of fact, the latter, by its long time associations, seems more like "home" than does the hospital. That "home" (U.S.A.) exerts a fatal attraction was clearly noticeable whenever a draft of surgical or psychotic patients was being made ready for evacuation to the States; on such days there was a distinct lowering of general morale on wards otherwise marked by their cheerfulness.

In conclusion it is suggested that the similar recovery rates achieved by other workers may at least in part be due as much to the intensity of the treatment as it is due to the treatment itself. In order to carry on any of these methods (hypnosis, sodium pentothal, modified insulin) much attention and care is required from the medical officers and the hospital staff; only organized and well-integrated teams can carry out these procedures. The staff and ward personnel must be geared for *treatment* in order to undertake successfully these therapeutic methods, and we believe that this very organization of therapeutic intent into a group, the staff, has in itself considerable therapeutic benefit for men with combat fatigue.

SUMMARY

A therapeutic program has been described for combat fatigue patients which we believe has at least in part been responsible for an 80-percent recovery rate in a forward-area hospital. This program is twofold, consisting of: (1) Active and specific treatment of anxiety symptoms and physical fatigue, individualized for each patient; and (2) a deliberate inculcating of an enthusiastic group feeling among all staff members, so that the patient is provided a substitute group with which to identify himself. This temporary group-membership supplies the identification and membership feeling with his own combatant unit, which the patient lost incidental to his developing combat fatigue.

An enthusiastic staff spirit can be stimulated by attention to interpersonal relationships and by the use of such proven psychiatric technics as occupational and recreational therapy programs actively participated in by the staff. By patience and by the use of improvisations, such a program can be organized even in a forward-area hospital.

When the anxiety symptoms have been treated and abated, and when the patient has become a temporary member of the hospital

"group," he is physically and psychologically ready to return to duty.

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PENICILLIN BY INHALATION

Calcium penicillin administered as a mist is very rapidly absorbed through the respiratory mucous membrane. Highly bacteriostatic titers can be established in the blood in this way, comparable to intramuscular and intravenous routes. The wastage of material involved is from 60 to 75 percent but the high values obtained in blood and urine encourage the hope that weaker solutions of less than 5,000 units per cc. could be used economically and successfully for the local treatment of infections of the respiratory mucosa and immediately adjacent tissues, such as in purulent bronchitis and bronchiectasis, and as a prophylactic against secondary pyococcal infections in influenza.—MUTCH, N., and REWELL, R. E.: Penicillin by inhalation. *Lancet* 1:650-657, May 26, 1945.



LIVER FUNCTION TESTS

In patients who are jaundiced, the best tests to use for the estimation of hepatic function are the serum protein determination (hypoalbuminemia) and the glucose tolerance test. Invariably such patients will have had a van den Bergh test already performed. In patients who are not jaundiced, it appears that the best tests to use are the bromsulfalein dye excretion test and the urobilinogen test. In these patients the van den Bergh too, will already have been performed. In either situation, the other tests may well add further information regarding the degree of impairment of hepatic function.—TEITELBAUM, M.; CURTIS, A. C.; and GOLDHAMER, S. M.: Comparative value of several liver function tests. *Ann. Int. Med.* 22: 653-666, May 1945.

PSYCHIATRIC SELECTION AT THE PRECOMMISSIONING LEVEL

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The problem of assembling and training ships' crews for new Naval construction resulted in the conversion of one of the Naval training stations into a precommissioning ship. Here were gathered ships' crews for advanced training while waiting the completion and commissioning of their ships, the men coming from various Naval sources, such as from training stations, from service schools, and from previous duty either ashore or in the fleet.

With the change in function from that of training station a question arose concerning the need for continuing a psychiatric unit. There were good grounds for assuming that such a unit would be necessary, and that re-examination of the precommissioning men would reveal many who were unfit because of neuropsychiatric defects. It is inevitable that the screening procedure at the training stations should make mistakes and pass on some unfit men to the fleet. Thus of the recruits discharged for inaptitude when the station was a recruit training camp, about 15 percent represented cases which were missed during the original screening examination and were referred to the psychiatrist later.

In addition to the persons who are missed at the training station level, there are some disorders which require a period of incubation before they are noticeable. This is particularly true owing to the increase of intrapsychic tensions in the green recruit when sea duty becomes imminent, as occurs when he is finally assigned to a ship's crew. Finally with many men coming from the fleet there inevitably will be cases of service-connected disability such as combat fatigue, posttraumatic personality disorder, and traumatic epilepsy.

In a previous article the authors¹ have discussed the need for

¹ WITTON, C. L.; HARRIS, H. I.; and HUNT, W. A.: Evaluation of brief psychiatric interview. *J. Psychol.* 16: 107-114, July 1943.

such periodic re-examination. Experience during the first 8 months of the precommissioning program has demonstrated amply the pressing need for psychiatric selection at this level.

The psychiatric program as finally evolved resembles that in practice at the recruit level with the exception of certain changes in standards, and in the procedures for separation from the service. It soon became evident that many of the cases of neuropsychiatric unfitness were fairly obvious ones which could be detected immediately upon the arrival of the men at the station, and it was decided after some experimentation to institute a psychiatric screening procedure to which every man entering the station would be subjected. The shortage of personnel made it impossible to give each man a special psychiatric interview, so the men were tested by a paper and pencil test with only the high scorers on this test receiving a personal interview.

An experimental run on over 1,000 cases showed that screening in this fashion would result in the detection of 80 percent of the eventual casualties during the training period, while necessitating the interview of only a quarter of the incoming population. Only about 25 percent of the men tested score high on this test, and it is the function of the psychiatrist in a brief personal interview to separate among this 25 percent those who are true neuropsychiatric problems from those men who have been mistakenly identified as such by the test.

As a result of this interview men suspected of neuropsychiatric defects are either sent to the observation ward for study preliminary to receiving a straight medical survey or a survey to limited shore duty, or they are sent on to duty for a trial period and re-interviewed later. Since most of these men have had some length of service in the Navy and represent quite an investment in terms of training, every effort is made to salvage as many for further service as possible. The granting of a medical survey for neuropsychiatric disability is a serious matter and not to be taken lightly, and it has been the policy of this station to survey only those men who are obviously unfit and whose unfitness is clearly demonstrated by their social histories and by their record in the Naval service. The procedures of investigation and observation are largely those which were in use when the training station was a recruit station, and which have been described elsewhere.² The main difference comes in the greater time and attention that must be given to the survey cases, and in the different method of dis-

² WITTON, C. L.; HARRIS, H. I.; and HUNT, W. A.: Detection of neuropsychiatrically unfit. U. S. Nav. M. Bull. 40: 340-346, April 1942.

position, because these cases now go through a regular board of medical survey rather than through the Aptitude Board.

As only the most severe cases are admitted to the psychiatric ward directly from the screening examination, a heavier burden is thrown on trial duty, referrals, and consultations than was typical of the recruit program. This increases the necessity for giving ships' officers general indoctrination into the necessity and operation of psychiatric selection. Fortunately all officers arriving on the station spend the first week after their arrival in indoctrination school where they are made familiar with the pre-commissioning program. As a regular part of the indoctrination a member of the psychiatric staff delivers a lecture to the officers on the necessity for psychiatric screening, recognition of common psychiatric cases, and the mechanics of referring such cases to the observation ward. This has resulted in excellent cooperation from the line and medical officers of the various ships' details.

As was typical of the procedure under the recruit training program all patients in need of immediate hospitalization are transferred to the Naval hospital. Transfer to the hospital is also utilized for those who need medical treatment not available under present facilities, and when there is every indication that the administration of therapy would produce beneficial results, as likewise where the man's difficulties are thought to have been aggravated by his Naval service. This results in a relatively greater number of hospital transfers than was necessary in the handling of recruits. Analysis of the cases handled demonstrates three sources from which they come and may be illustrated by case reports.

CASE REPORTS

MISTAKES OF TRAINING STATION SELECTION

Case 1.—A youth with a mental age of only 10 years, whose mental deficiency was further complicated by his illiteracy, could read only at a first-grade level. School and work records were poor. At the training station he was transferred to a school for illiterates. When he showed no progress after 5 weeks at this school, he was transferred here for assignment to a combat ship. Here he was unable to perform his duties as a crew member and was referred to the psychiatric ward by his ship's medical officer. He was surveyed as a mental deficient.

Case 2.—This man was unstable with a long history of maladjustment previous to enlistment. He once had gastric ulcers, and had been under treatment by his local physician for his "nervous condition." A few days after his arrival at the training station he became very nervous and was sent to sickbay by his company commander. Here he was placed under sodium bromide sedation for the remainder of his recruit training, after which he was transferred to a precommissioning crew, where he was detected during

the screening examination. He showed obvious signs of a severe anxiety state and was admitted to the ward for survey.

Case 3.—A youth who had a history of occasional grand mal seizures previous to enlistment had been under treatment by his family physician. He concealed his condition at the induction center and later when he arrived at the training station. He had two mild seizures during his boot training and was referred each time to the sickbay for treatment. The epileptic symptoms, however, were not recognized and he was treated for syncope. He was detected during screening examination and was surveyed when the diagnosis of epilepsy was confirmed by the social history and by an abnormal electroencephalogram.

CONDITIONS IN WHICH A PERIOD OF INCUBATION IS NECESSARY

Case 1.—This man was unstable with a history of mild anxiety before his enlistment. During his recruit training he was very anxious and depressed but did not seek medical attention. During the screening examination upon his arrival at the station his condition was detected, but it was thought to be simple nostalgia and he was given superficial therapy and sent to duty. By the end of 2 weeks a situational depression of considerable depth had developed accompanied by severe headaches and vomiting of a functional nature. He was surveyed.

Case 2.—This man had a history of a suicidal attempt 5 years previously. He concealed his history when he was inducted. During his recruit training he became anxious and apprehensive but did not seek medical attention. Following recruit training he was sent to service school where it was necessary for him to seek medical attention for his condition. He was given sedatives for several days. His condition became aggravated and upon his transfer here he was immediately detected during the screening examination. He was exceedingly tense, anxious, and apprehensive, and confessed to a return of suicidal thoughts. He was transferred immediately to the Naval hospital.

Case 3.—This person was unstable with a history of extreme nervousness and maladjustment before enlistment. He had never sought medical attention in civilian life. He was detected during the screening examination at his recruit training camp and was admitted to its psychiatric observation ward. There his condition improved somewhat and he requested a chance to serve. As a result he was sent to duty. His condition became aggravated during a period at service school and upon his transfer here he was detected immediately during the screening examination and referred to the psychiatric ward for survey.

SERVICE-CONNECTED DISABILITIES

Case 1.—This man had received a fractured skull when tossed to the deck by the concussion of a shell explosion. He was hospitalized for 1 month and then returned to duty. For a while he had headaches but these were infrequent and less severe with time. Six months later while at a shore station his headaches began to occur more frequently and with greater severity. Shortly after this he had two convulsive episodes. He was allowed to continue on duty but was under outpatient observation at a Naval hospital when he was suddenly transferred here. He was detected at the screening examination, but until his health record could be checked and an electroencephalogram obtained he was sent to duty. Before this could be done, however, he had another seizure. He was transferred to the Naval hospital.

Case 2.—This young man's ship had been torpedoed. While in the water he received severe internal injuries attributable to exploding depth charges. These necessitated his hospitalization for 6 months. He received attention for his physical injuries but no psychiatric examination was made. When he was physically sound again, he was returned to duty and sent here. He was detected in the receiving examination as tense, anxious and apprehensive. Further observation showed him to be suffering from severe combat fatigue and he was transferred to the Naval hospital.

Case 3.—This youth's ship was torpedoed while he was in his bunk. He escaped but spent 12 hours in the water before he was rescued. He was shipped back to the States and given a 30-day leave. During the leave, insomnia, restlessness, anorexia, and terror nightmares developed, despite which he did not seek medical attention. At the end of his leave he was assigned to a new cruiser but during the shakedown cruise he found that his anxiety symptoms were aggravated, and that he was unable to sleep below decks. He asked for transfer from the ship and was sent here. His obvious anxiety was immediately noticeable during the screening examination. He was diagnosed as having severe combat fatigue and was surveyed to shore duty.

Tables 1, 2, and 3 analyze the men separated from the service, surveyed to limited shore duty, or transferred to the Naval hospital from this activity during the month of July 1944. Table 1 shows the relative percentages referred for disposition from various sources. It will be seen that the original screening examination is the largest source. The large numbers referred from other sources in part reflect our liberal trial duty policy. Table 2 lists the diagnoses established in the order of their frequency. Table 3 gives the length of service of the men. It is significant that one-third of these patients have had less than 4 months' service in the Navy.

TABLE 1.—*Sources of referral for cases separated from service, surveyed to shore duty or transferred to hospital July 1944*

Sources	Percentage of total cases	Sources	Percentage of total cases
Screening.....	32.0	Chaplain.....	1.0
Main sickbay.....	31.0	Classification officer.....	.3
Detail sickbay.....	22.0	Battalion commander.....	.3
Captain's mast.....	9.0	Dental department.....	.3
Self referral.....	4.0		

The opportunity for the indoctrination of line officers in the principles of neuropsychiatric selection is one of the most important aspects of the selection work at this precommissioning station. The original neuropsychiatric selection program was instituted by a joint directive from the Bureau of Naval Personnel and the Bureau of Medicine and Surgery to the commanding officers of the various Naval training stations. Unfortunately it was not possible to instruct the line personnel of the Navy in the

TABLE 2.—*Diagnoses established for cases separated from service, surveyed to shore duty or transferred to hospital July 1944*

Diagnosis	Order of frequency	Diagnosis	Order of frequency
Constitutional psychopathic state.....	1	Epilepsy.....	6
Emotional instability.....		Constitutional psychopathic inferiority.....	7
Inadequate personality.....		Without psychosis.....	8
Schisoid personality.....		Dementia praecox.....	9
Paranoid personality.....		Mental deficiency.....	10
Psychoneurosis.....	2	Moron.....	
Mixed.....		Psychosis.....	
Anxiety.....		Unclassified.....	
Hysteria.....		Manic depressive.....	
Situational.....		With psychopathic personality.....	11
Psychasthenia.....		Posttraumatic personality disorder.....	12
Unclassified.....		Left ear deafness, infection.....	13
Traumatic.....		Keratitis.....	14
Fatigue.....	3	Paralysis.....	
Combat.....		Right facial nerve.....	
Operational.....		Enuresis.....	15
Mental observation.....	4	Nystagmus.....	16
Posttraumatic cerebral syndrome.....	5		

philosophy and practice of military selection at the time the program was instituted, and since the program was begun in Naval training stations there was little understanding of it among those in command at sea. The various ships' officers' impressions were formed largely through whatever discussion appeared in public print, and this unfortunately often gave a distorted picture. Here at the precommissioning station where officers and men are gathered prior to their being assigned to new construction it is possible for the ships' officers to see neuropsychiatric selection functioning in relation to their own personnel problems. It is no longer an abstract question, but becomes a concrete matter of handling the disposition of men whose unfitness for sea duty becomes apparent to their officers during this final training program. Under these circumstances the line officer is getting new insight into the meaning of psychiatric selection through his direct participation in the functioning of the program. The response has been enthusiastic.

There exist, however, many borderline cases of persons who are temperamentally unfit for military service and who are unable to adjust adequately to the demands of an efficient Naval organization but nevertheless do not fall clearly into any medically

TABLE 3.—*Length of service of cases separated from service, surveyed to shore duty or transferred to hospital July 1944*

Length of service	Percentage of total cases	Length of service	Percentage of total cases
More than 1 year.....	32.0	3 months or less.....	25.0
More than 6 months.....	10.0	2 months or less.....	10.0
6 months or less.....	7.0	Less than 1 month.....	.3
5 months or less.....	4.0	Unknown.....	.6
4 months or less.....	11.0		

diagnostic category. A man may be discharged by reason of medical survey only when a clear medical condition exists and a diagnosis can be established. Despite the fact that many of these borderline cases are not medical problems in the usual sense, they remain unfit for service and their unfitness becomes apparent the minute they undertake duty at sea. As a result once their unfitness is discovered, they are disposed of by transfer to another ship. In this way a floating population is set up which is transferred from ship to ship, finding no welcome anywhere. This has been observed here at this station where men have been on the psychiatric ward and sent back to duty because it was impossible to handle them by medical survey despite the psychiatrist's personal opinion that they were unsuited for service. Regularly a few months later these men were seen once more at the precommissioning station in a draft from sea for assignment to another vessel. There is one group of approximately 6 men; these are now in their third crew within 6 months. No one wants these men because of their unsuitability; yet it is impossible up to the present date to eliminate them through the channels of medical survey as they are not a medical problem.

SUMMARY

Nine months of neuropsychiatric selection at a precommissioning level has shown the value of such a program. Many unfit men are found at this level and their elimination is essential to an efficient fighting organization. No ship is better than the crew that fights it and a neuropsychiatric problem among her personnel strikes directly at her efficiency and morale. The importance of the men's physical condition is recognized in the principle of physical re-examination at regular intervals. Experience at this station would suggest that a regular psychiatric re-examination would be of equal value and importance.



CORRECTION

On page 567 of the September BULLETIN in a review of "A MANUAL OF TROPICAL MEDICINE," last paragraph, change the opening words "The two volumes are . . ." to read "The manual is . . ." Next to last line on page, change "216" to "290".

Page 568, the sixth line should read:

"eran, in 1880, reported the finding of a protozoan in malarial . . ."



PREVENTION OF SEASICKNESS

Experiments on the prevention of seasickness were carried out in the tropics during the training of troops under conditions closely approximating those of battle. The drugs tested and the number of observations on each were hyoscine, hyoscine plus amphetamine, hyoscine plus ergotamine, chlorbutol, and ergotamine. A high degree of reliability is shown for the hyoscine, hyoscine plus amphetamine, and for some chlorbutol experiments. Of the remedies tested, hyoscine, 1/100 grain, proved most effective. The degree of protection was of the order of four-fifths of those susceptible. This degree of protection was observed in relatively calm seas, when the seasickness rate in controls was 16 percent.—HILL, I. G. W., and GUEST, A. I.: Prevention of seasickness in assault craft; report of experiments under tropical conditions. *Brit. M. J.* 2: 6-11, July 7, 1945.



CHEST PAIN OF STOMACH ORIGIN

The clinical analysis in 24 patients with pain in the chest due to disorders of the stomach showed that in a number of subjects the pain radiated from the precordial or substernal region to the left shoulder and arm, and resembled in character and in intensity the distress caused by disease of the coronary arteries.

Most of the cases fell into 1 of 2 groups: (1) Functional distention of the stomach due to pylorospasm, aerophagia, ptosis or a combination of these factors, and characterized by mild pain, relief by belching, a tendency for the pain to be aggravated by lying on the left side, the coexistence of palpitation, pronounced relationship to emotion, the presence of anxiety reactions out of proportion to the intensity of the pain, and the frequent occurrence in young to middle-aged females; (2) disorders dependent on abnormal pouches in the fundic end of the stomach including hernias, diverticula and cascade deformities, and characterized by pain of mild to intense severity, radiating to the left side of the chest, shoulder and arm, spasmodic and intermittent character, aggravation by ingestion of alcoholic beverages, marked relationship of the pain to eating and to the position of the body, and a tendency to simulate closely the pain of angina pectoris or of myocardial infarction.—HARRISON, T. R.: Clinical aspects of pain in chest; pain arising from stomach. *Am. J. M. Sc.* 209: 771-783, June 1945.

EVALUATION OF A MOTION SICKNESS QUESTIONNAIRE IN PREDICTING SUSCEPTIBILITY TO SEASICKNESS

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Correlation between various types of motion sickness has long been suspected and has led to the use of the expression in place of airsickness, train sickness, car sickness, and the like when a general term is desired. Several investigators have discussed the problem of detecting future cases of severe motion sickness through the use of a questionnaire or similar procedure based on the individual's past history of the various types of motion sickness (1) (2) (3).

Alexander and his collaborators found a positive correlation between questionnaire data and responses in a vertical motion machine, and between the questionnaire and airsickness (3). Schwab expressed the opinion that a questionnaire could detect that group of individuals who are "constitutionally" susceptible to motion sickness (2). He based his view on his observations of a group of 38 cases of chronic seasickness in the Navy.

The purposes of this study were (1) to determine the extent to which a history of motion sickness, as secured by a questionnaire, was related to susceptibility to seasickness; and (2) to discover to what extent common somatic and psychosomatic complaints were related to susceptibility to seasickness.

PROCEDURE

A questionnaire comprising a survey of the possible conditions of motion that tend to make individuals sick was given to 277 Naval personnel with sea experience. In addition to the questions concerning motion sickness, other items were included, such as a question about satisfaction with duty. This was used to examine

the possibility that dissatisfaction might make a subject more prone to emphasize his seasickness. Other questions concerned somatic complaints of possible psychoneurotic basis, and phobias and apprehensions about life at sea.

The completed questionnaires were divided into two groups, (a) those of men always or frequently seasick, and (b) those of men rarely or never seasick. This division was based on four criteria: (1) The individual's opinion of his own tendency to become seasick; (2) actual observation of the men at sea by investigators concerned with this study; (3) ratings of susceptibility to seasickness by superior officers; and (4) reports of Boards of Medical Survey on those men surveyed to shore duty because of chronic seasickness. Of the 277 men who filled out the questionnaires, 229 were rated for susceptibility on all of the first three criteria. Forty-eight others, who had been diagnosed as "chronically seasick" and surveyed to shore duty, were rated on the basis of the first and fourth criteria and all of these were classed in the group "always or frequently seasick."

This classification yielded 174 questionnaires of men in the "never" or "rarely" seasick group, and 104 questionnaires in the "always" or "frequently" seasick group. Using this dichotomy as the validating criterion, an item analysis of the questionnaire was then carried out. The work was facilitated by the use of Thurstone's computing diagrams (4).

As a result of analysis of the questionnaire described, a second questionnaire was developed. This form called for responses concerning 19 situations involving motion. The questionnaire was scored by giving 2 points for every item checked as "always" or "frequently" making the individual sick (to the extent of nausea or vomiting or both), and one point for every item checked as making the individual "sometimes" or "rarely" sick. No attempt was made to weight the specific terms, since the analysis of the first form of the questionnaire had shown a very restricted range of validity coefficients. Scores were adjusted to account for the lack of experience on some of the items by expressing the sum of the points on the experienced items as a percentage and then multiplying this percentage by the 36 possible points to get the adjusted score.

Inasmuch as the efficacy of predicting severe seasickness from a history of motion sickness was to be determined by this study, the one direct question regarding seasickness was not included as part of the motion sickness score. There being 18 items, seasickness omitted, and a maximum of 2 points on each item, the maximum total score was 36, which indicated extreme susceptibility to motion sickness.

RESULTS

The complete item analysis of the 277 questionnaires of the first form proved conclusively that questions not directly concerned with motion sickness have little value in predicting susceptibility to seasickness. The following items had no correlation with the criterion, or so slight a correlation as to be useless in a motion sickness questionnaire: (1) Satisfaction with type of Navy duty; (2) incidence of headaches; (3) incidence of constipation; (4) incidence of indigestion; (5) feeling "weak" at the sight of blood; (6) feeling ill at the sight of disgusting refuse; (7) fainting when giving a blood sample or when receiving an inoculation; and (8) apprehension about any aspect of Naval duty, such as drowning, fire, or explosions.

The two items that correlated highest with the criterion were car sickness and expression of like or dislike for Ferris wheels and merry-go-rounds (tetrachoric $r = .54$ and $.55$ respectively). Sufficient independence of variance exists between like (or dislike) of amusement park devices and reports of motion sickness on these devices to indicate that both types of item may profitably be included in a motion sickness questionnaire. For example, "Do you like roller coasters?" and "Have you ever gotten sick on a roller coaster?" are both good questions, since they correlate significantly with the criterion and the correlation between them is low. All of the items specifically concerned with motion sickness correlated higher (with one exception), than $.43$ with the criterion.

Frequency distribution of motion sickness questionnaire scores

	Scores	Control group N = 48	Group surveyed to shore duty N = 48
Suggested cut-off score	0- 1	22	0
	2- 3	10	3
	4- 5	7	0
	6- 7	6	3
	8- 9	1	3
	10-11	0	4
	12-13	0	4
	14-15	0	4
	16-17	0	4
	18-19	1	4
	20-21	1	5
	22-23		6
	24-25		2
	26-27		1
	28-29		2
	30-31		0
	32-33		1
	34-35		2
	36		

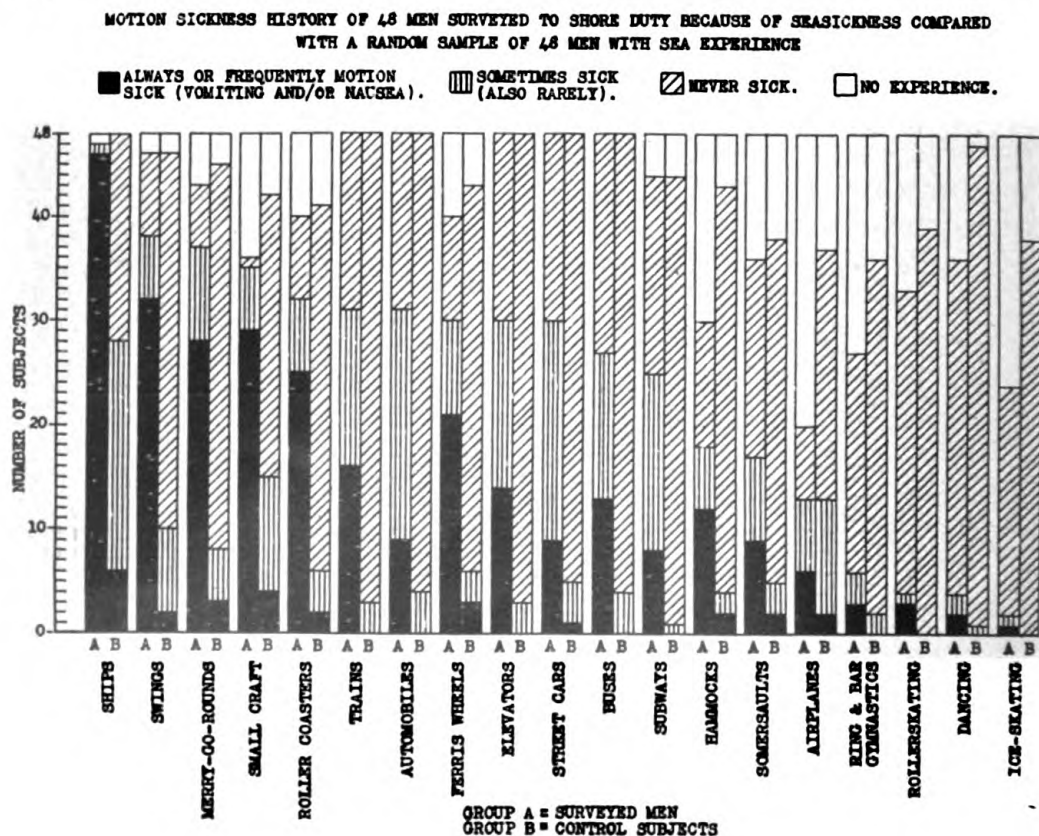
The score distributions from 48 "chronic seasickness" cases and 48 controls on Motion Sickness Questionnaire, Form 2, give ample evidence that men highly susceptible to seasickness more

frequently have extensive histories of other sorts of motion sickness than do individuals more resistant to seasickness, as shown in the accompanying table. The biserial correlation of the data in this table is $.93 \pm .04$. The distributions are sufficiently discrete to permit a "cut-off" score to be used in separating the two groups. If a score of 10 points were chosen for this cut-off, 4 percent of the control group and 81 percent of the very susceptible group would be eliminated. The tetrachoric correlation between the two dichotomous classifications (seasick and controls vs. above and below the cut-off score) is .94.

The results for the individual items in Form 2 show, without exception, that a larger proportion of the "chronic seasickness" group than of the control group have been affected by experiences of motion sickness. This is true whether the category "always" or "frequently" sick be taken as the basis of comparison or whether this category be combined with those classified as "sometimes" or "rarely" sick. One subject appearing in the surveyed group in the accompanying graph is indicated as having no experience on ships because of his duty with small landing craft.

COMMENT

Several points in these results merit discussion. First, the analyses of both forms of the motion sickness questionnaire used in



this study are consistent in demonstrating a significant relation between seasickness and other forms of motion sickness. It would appear from the analysis that susceptibility to motion sickness is a rather specific factor. The results are surprising in that they demonstrate no relation between the usual psychosomatic complaints and susceptibility to seasickness. While it may be true that in individual cases conditioning may markedly facilitate or inhibit motion sickness, the generalization that there is usually a psychologic basis for motion sickness appears unwarranted.

The validity coefficient, .93, found for Form 2 of the questionnaire, is so high as almost to be subject to suspicion. Two factors in the experimental situation probably account for this result. One of these factors is the tendency of the men who have been surveyed for seasickness to emphasize their history and to be more self-reflective about motion sickness in general.

The use of 48 such men as a criterion group is thoroughly justified from the point of view of experimental design. On the other hand, since each of these men had been examined and interviewed at a Naval hospital before becoming available for this study, it is not improbable that they became more interested in their motion experiences and more reminiscent about them than the average person.

Although the above consideration might lead to the conclusion that the validity is spuriously high, it is also true that the questionnaires were answered with high accuracy, as evidenced by subsequent interviews. This accuracy and honesty was achieved by assuring all subjects that their questionnaire replies would in no way affect their Naval status and were for research purposes only. In any situation where this assurance could not be given the questionnaire answers would probably be less valid and would show less correlation with susceptibility to seasickness. In any situation where reliable results are of special importance the questionnaire could be filled out by an interviewer after adequate questioning.

The criteria used in these studies have permitted little distinction between those individuals of average susceptibility and those very resistant to seasickness. Thus the questionnaire in its present stage of development is intended to function as a screening device for selecting those men most likely to be incapacitated by seasickness if sent to sea. It is expected that the motion sickness questionnaire, like any test or questionnaire, will undergo modifications and adaptations to improve it as an instrument, and to adapt it to machine scoring technics. The application of the questionnaire to a training situation appears to be the most feasible

next step. This situation would permit follow-up studies to be made and might lead to other improvement of the content and scoring of the questionnaire.

SUMMARY

1. A motion sickness questionnaire was given to 277 male Naval personnel whose susceptibility to seasickness was known by several independent criteria: (1) The individual's own judgment of his susceptibility; (2) observations of the men at sea by the investigators concerned with this study; (3) susceptibility ratings of the men by their officers; and (4) the judgment of the Boards of Medical Survey in the case of men surveyed to shore duty because of seasickness.

2. An item analysis of the questionnaire was undertaken, using the tetrachoric correlation technic.

3. All of the items specifically related to a history of the various types of motion sickness correlated significantly with the criteria (median tetrachoric $r = .48$). None of the items of a general nature, e.g., headaches and constipation, had a correlation with the criteria significantly greater than 0.

4. A second questionnaire, dealing primarily with motion sickness history, was then developed. When this questionnaire was given to 48 men surveyed for seasickness and to 48 other men with some sea experience, a biserial correlation of $.93 \pm .04$ was found between the questionnaire scores and susceptibility to seasickness.

5. It would appear from the clustering of correlation coefficients that susceptibility to motion sickness is a rather specific factor. Despite the fact that a group of men very susceptible to seasickness may contain a higher than normal incidence of psychologically disturbed persons, no evidence was found that indicated a correlation between general psychosomatic complaints and susceptibility to seasickness.

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EVALUATION OF THE COMPARATIVE EFFICIENCY OF VARIOUS METHODS OF MASS RADIOGRAPHY

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The introduction of photofluorography as a tool for the detection of tuberculous lesions in apparently healthy persons has revolutionized the field of tuberculosis control. This can be observed most strikingly in the screening of the tuberculous among the men and women examined at induction stations of the armed forces.

Four types of film are being used in mass radiography, the 35-mm., 70-mm. and 4- by 5-inch celluloid, and the 14- by 17-inch paper film. The advantages of each type of film vary according to personnel requirements, economy of material, and speed of operation. In addition there is considerable variation of opinion among radiologists concerning the best application of each of these technics.

In evaluating the efficiency of any one technic, the different functions which are to be performed must be considered. For example one technic may be most satisfactory for surveys in industry; another may be more economic in surveying patients admitted to a general hospital and another may be suited especially to use in clinics. Before any one of these technics can be applied effectively, its relative efficiency in detecting pathologic lesions must be determined. Comparative study of the percentage and type of lesions missed by various technics helps to determine the relative value of each for a specific function.

Methodology.—To evaluate the diagnostic accuracy of the several mass radiographic methods a number of comparative studies have been made in recent years. Results have been extremely

variable. The Navy Department and the U. S. Public Health Service have had considerable experience with 35-mm. films. Because of the great technical improvements in this method during the past few years, a study was initiated to determine the diagnostic accuracy of the most recent types of 35-mm. film.

On the surface such a study seems simple. Apparently all that is necessary is the selection of a group of subjects to be x-rayed by the various methods, including 14- by 17-inch celluloid films, followed by mere tabulation of results. In practice, however, the task involves meticulous attention to detail.

Before presenting the results of any comparative study of 35-mm. and 14- by 17-inch celluloid films, some principles of methodology, combining the results of experiences in a number of such studies, should be outlined. The data presented in this paper are based on the survey of over 2,200 Navy personnel, and on other special studies with which the authors have been associated. These include a study conducted in mental hospitals in 1939, an investigation of rejectees in Washington, D. C. in 1940 and 1941, and a more elaborate study now being made by the Veterans' Administration with the assistance of the United States Public Health Service.

One of the most common errors found in comparative studies of x-ray technics is the comparison of films of two different groups of persons, each examined by a different technic. The frequency and type of pathologic conditions found by each method is then contrasted. Such evidence is too indirect and may be fallacious. It is impossible to find two population groups so similar as to yield the same amount and type of chest pathosis. The comparison of such results is not amenable to exact analysis because of many unknown factors.

The more accurate method of comparing technic is the x-ray examination of the same group of persons with various types of film at approximately the same time. The end results may then be compared. It is of little value to know that different methods will detect the same percentage of pathologic findings in two groups of persons, but it is important to know whether different methods will detect similar pathosis in a particular person.

Another common error in comparing different technics is failure to have all films read by the same person. One radiologist reads the 4- by 5-inch film, another the 14- by 17-inch film, and the readings are compared. The results of a number of studies show that interpretations of the same film by two or more readers will vary. The results of a study based on compared readings will indicate more variability between readers than between technics.

The type of population sample chosen for comparative x-ray studies is a frequent source of error. In so far as possible the type and size of lesions found in the sample groups should correspond to those found in the general population. Large, well-defined lesions will be detected by all technics, hence comparative studies should concentrate upon determining the accuracy in detecting minimal lesions. Were it not for the prohibitive cost, the ideal and most accurate comparisons could be obtained by dual or triple x-ray examination of a large random sample of apparently healthy population, using each type of x-ray technic at approximately the same time on each person.

In recent mass surveys in the United States, frequency of reinfection tuberculous lesions in the adult population is found to be approximately 1.5 percent. About two-thirds of these are minimal lesions. To accumulate 200 minimal lesions for study, it is necessary to examine 20,000 persons. The cost of such a study, including the reading of the films, is excessive. To cut cost in such a study it becomes necessary to add known tuberculous cases to supplement those found in a small survey. In other words a survey is conducted on a reasonable number of apparently healthy people. In the course of such a study some tuberculous persons who are known in the community are brought in and examined along with the apparently healthy people.

However two main requirements must be satisfied in using this method and these are difficult to meet. The first is that these known cases must not have been detected originally by the technic being tested. If the study proposes to evaluate the 14- by 17-inch paper films, it is not advisable to include among the added known cases those persons with lesions originally discovered by 14- by 17-inch paper films. The mere fact that these lesions were detected by this method at a previous time would almost insure their detection again by the same technic. It is necessary to investigate each such case to be certain that it was originally detected by means of a 14- by 17-inch celluloid film. The second requirement is that the known lesion be selected not because of size or distinctness, but because it is representative in size and type of the minimal lesions commonly found in a random sample of the general population.

Equally important in conducting a comparative study is the interpretation and classification of shadows on the x-ray film. Reports do not always indicate the type of lesions missed. If one investigator includes calcific lesions under the heading pulmonary tuberculosis, whereas another excludes them, the latter will have less variation in his percentage of error. If one inves-

tigator includes 75-percent moderately- and far-advanced lesions, and another confines himself to 75-percent minimal lesions, the former is less likely to err, because of the prevalence of extensive lesions. Therefore in presenting the results it is important not to state in general terms the percentage of total lesions missed but to present separate figures for the different diagnostic categories.

There is a tendency on the part of any interpreters to minimize the significance of the lesions missed. A number of such lesions are thus discounted from the percentage missed because the investigator thinks that they are of no significance and therefore should not be counted as misses. The objection to such a technic is that it is impossible to determine on the basis of one film which lesion is important, which lesion may or may not break down. Ability to determine the importance of a lesion on the basis of one film alone is uncommon even among experienced interpreters.

The most difficult step of any comparative study and the one wherein most errors are committed, is the analysis of results. This seems a simple task but in actual practice it is difficult to segregate and evaluate all the human errors in interpretation and to accommodate for the reader's inability to be consistent with himself and with other interpreters.

This paper does not aim to present new results but to correlate the knowledge gained in past investigations for the guidance of others who conduct such studies.

Mechanics of conducting a survey.—For the purpose of this discussion it is assumed that the investigation relates to the four common types of film, 35-mm., 70-mm., 4- by 5-inch stereoscopic celluloid films, and 14- by 17-inch paper films, with the 14- by 17-inch celluloid film being used as a control.

The first consideration is equipment. This should be of the highest possible quality and latest design. With constant improvements in all the technics, equipment quickly becomes obsolete. Any comparative study evaluates the different technics as of a given time. If new technical developments appear, such a study must be re-evaluated to determine to what extent the technical improvement affects the diagnostic quality of the technic.

The type of technician used in the actual execution of the study is important. Persons with considerable experience and best qualified to use the different technics should be selected, since the true value of the technics will not be revealed if the technician is a poor "positioner," a poor operator, or a poor developer of films.

Selection of sample.—One of the important considerations is

the selection of persons to be examined. The best group is made up of a large number of apparently healthy people. Since this is not always feasible, some method of supplementing the study group with a number of known clinical cases, becomes necessary. The cases added to the total group must have been detected originally by 14- by 17-inch films. The group selected should be sufficiently stable to permit re-examination after a lapse of one or two years. After re-examination, the importance of lesions previously missed with small film (but found on large film) can then be evaluated. The number of such lesions that show breakdown during the time interval is the index for measuring their proportionate significance.

Procedures for conducting the examination.—It must be emphasized that the purpose of a comparative study is to determine diagnostic efficiency and not speed of operation. Consequently the rate of examination need not be too rapid, because the pace is set by the slowest rather than by the fastest x-ray unit. The slowest unit generally is the machine used for taking the 14- by 17-inch celluloid films.

Record cards should be made out in advance for all the people scheduled to be examined on a given day. Each card should contain identifying data, including name, address, and other pertinent information such as badge number, office telephone number, age, race, sex and occupation. Other special data may be added as desired.

Each person to be x-rayed should be assigned a film number by the clerk before examinations begin. If the group is small, a different film number for each type of x-ray film will eliminate the possibility of associating a specific number with a specific case, in reading films. The master index card for each person should allow space for these numbers, which can be so arranged as to tell at a glance which type of film each number represents.

Errors of identity can be avoided by careful cross-checking. The case number is already on the card when the person appears for x-ray. The technician should check this number against the one he inserts in the film, at the same time marking the card number to indicate that the film for this number has been taken. After a person has had roentgenograms made by all units, his card is returned to the clerk. Here the card is examined to ascertain that the x-ray number for each unit has been checked as being taken. Should any number not be marked appropriately, immediate investigation can pick up the error in time.

It is important to expose and develop sample films each morning and afternoon in order to be certain that no technical break-

down has occurred. If films of any one technic are spoiled, there is not only a waste of film for the technic evaluation, but the entire group of films of that day is eliminated for comparison. Therefore each group of technicians operating each machine must realize that failure of one unit affects all others. It is best to develop films daily and have an experienced interpreter check their quality. If films for one unit are technically poor, it may be possible to obtain a duplicate series of the same group the following day. Good developing facilities at the place where the study is being conducted are imperative.

Safeguards against stray radiation are needed. With four machines operating it is necessary to have sufficient lead screens to separate each technician from his own machine and from adjoining machines.

If known cases are included in the survey, it is best to scatter them throughout the day among the survey groups, to avoid many positive films coming close together on the rolls. These cases should be identified on the card but should not be made known to the technicians and interpreters directly connected with the study.

Selection of interpreters.—The selection of medical officers who will interpret the films is most important, because the value of the study will depend greatly on the ability of the readers, their experience and their understanding of the objectives of the study. The use of the plural in mentioning readers is intentional, because more than one person must read and interpret the films. It is known that considerable variation exists among different readers who interpret the same material. Analysis of the survey data requires a common denominator of several expert opinions.

If the study involves three or more methods, as many as three or more different interpreters may be needed. Several problems arise in selecting readers. If more than one technic is used it is not necessary to obtain reader-experts in all the technics, but every reader should be expert in interpreting 14- by 17-inch celluloid films, and experienced in at least one mass survey method.

It would be helpful to know the extent of the readers' experience in each of the technics. If two readers are exceptionally well qualified in one technic, their score on that technic should have more weight than the score of others who are not so well qualified. Others may have had extensive experience in a second technic, so their score would carry more weight in that technic. Ideally, among the several readers, at least two should be experts in one technic and have considerable familiarity with other technics.

This poses a question concerning the general objectives of the study. Is it really necessary to have all the readers attain a de-

gree of expertness that is not commonly found? In order to determine the smallest number of lesions that will be missed under the best conditions with the best interpreters in the field, such skill is required. However another objective of the study may be to determine what percentage of findings would be missed by readers of ordinary ability who are doing the major portion of survey work throughout the country.

A large amount of x-ray work is being done in this country today, and the films are not being interpreted by the outstanding radiologists and chest specialists, but by experienced, well-qualified people who attain a certain degree of expertness and familiarity with the technic. Many could not qualify as experts. It may be just as important to determine their score and to know what percentage of films are missed by these people, using various x-ray technics.

When readers have been selected, a preliminary meeting with them before the study gets underway is desirable. They then become familiar with the study and with what is expected of them. The main purposes of this meeting are twofold: First, agreement upon nomenclature or classification for grouping the lesions as uniformly as possible into distinct categories; the second, and probably the more important purpose, is to review a series of sample films made with various technics, to experiment with the proposed classification, and to see if it will work in actual practice.

Generally it will be necessary to read considerable numbers of films jointly before a reasonable uniformity of classification is attained. During the process of reviewing the films, each reader must record his readings before any discussion about the films takes place.

Readers must realize that a study of this type takes time. Readings must be unhurried, complete, and carefully recorded. Persons too busy to devote necessary hours to the study should not be asked to participate. The readers should agree beforehand to read the 14- by 17-inch celluloid plates a second time after an elapsed period. This is necessary to eliminate the human factor or personal variations of each reader, in reading the same material twice.

The experience gained through studies conducted in the past by one or more of the authors indicates that the simpler and fewer the specific categories of diagnosis, the better the chance for meaningful results. The classification developed for the latest study is simple. In terms of specific diagnoses, the films are to be grouped as follows: (1) Essentially negative; (2) calcification; (3) pulmonary scars; (4) minimal tuberculosis; (5) moderately-

advanced tuberculosis; (6) far-advanced tuberculosis; (7) suspected tuberculosis; (8) other pathologic conditions; and (9) pleural changes.

By pulmonary scars is meant unimportant scars, including discrete fibrotic strands presumably of tuberculous origin, whereas minimal tuberculosis indicates minimal tuberculosis according to National Tuberculosis Association classification (of more importance than those classified under No. 3).

Readers are required to give a general opinion of the entire film and to classify the films into one or more of the following five groups, designated T, S, O, N and U. Where T signifies tuberculous pathologic process; S denotes suspicious tuberculous pathologic process; O, nontuberculous pathologic process; N, essentially negative films; and U, unsatisfactory films.

The "N" does not imply that the film is entirely clear and negative. It could contain certain anomalies and abnormalities which are unimportant from a public health point of view.

The reader fills out a report on all films considered to be characteristic of tuberculosis, and a diagrammatic sketch of the lung condition. This combination serves two purposes. The first aims to obtain the reader's impression of the location of the lesions that have been seen; the second permits double analysis, one of the person and one of the lesions. There will be a number of films in which more than one lesion is present. For detailed analysis it is not sufficient to know that the person has been labeled or selected as positive by the different technics. That *all* the lesions present in the person's lungs have been detected is important. These two analyses often yield different and interesting results.

A method has been found to reduce total time spent in reading films. The reading of the films is a long and tedious task, particularly when many technics are being tested. For example, if the study consists of 4,000 persons on whom 4 films of different types have been taken, the reader must consider each one of these films in addition to reading the 14- by 17-inch film twice. He would have to read 5 sets of 4,000 films each, or a total of 20,000 films. Therefore it becomes desirable to eliminate those films which can be established as being unquestionably negative. Every time such a film is eliminated there is a reduction in the reading of 5 films for each reader, or 25 readings if there are 5 readers.

To ascertain that no film is eliminated about which there may be the slightest doubt, 4 nonparticipating readers are selected, each of whom has special skills in one technic. Each specialist then reads the entire set of films of one technic. A person familiar with the interpretation of 35-mm. films, reads all the 35-mm. films

and classifies them roughly into three groups: (1) Films that show pathosis; (2) films that indicate slight lesions or mere calcific lesions, or that may be unsatisfactory; and (3) those films which, in the opinion of the reader, are unquestionably negative.

The work is done independently by each of the "unofficial" readers. After the readings are completed the only films eliminated from the study are those of persons who have been read negative in all 4 technics by 4 independent readers. Films which some readers would call negative but which others put in the questionable group remain in the study. It is believed that such a procedure reduces to an absolute minimum the chances of having eliminated from the study a film indicating a pathologic condition. If it is possible by such means to reduce the number of films in the study by even 25 percent, the amount of reading time saved is considerable. Actually a 50-percent reduction in the number of films to be read is easy to attain.

Analysis.—The question which a comparative study of different sized chest x-ray films aims to answer can be stated very simply. How many possible films on the standard 14- by 17-inch celluloid films are missed by each of the various mass radiography methods tested? The percentage of positive films missed by any technic is a composite figure and results from many factors, some of which are easy to measure, others subjective in nature and unrelated to the special technic under investigation.

The complexity of relationships of the several factors involved may be illustrated by considering the simplest type of study; testing of one technic only, for example, the 35-mm. film. One person "A" is to interpret these and the corresponding 14- by 17-inch celluloid films. To simplify the illustration further, suppose that the films are classified into only two categories, negative and positive. The interpretation of the films can then be tabulated, and it will be found that a number of films have been called positive on both technics, whereas others have been called positive on the 14- by 17-inch celluloid films and negative on the 35-mm., and still others have been called positive on the 35-mm. and negative on the standard. Dividing the number that were missed on the 35-mm. by the number called positive on the standard, a percentage "p" is obtained denoting under-reading or "misses." The ratio of the number that was called positive on the 35-mm. and negative on the 14- by 17-inch celluloid film to the number of positives found on the standard, furnishes the percentage "q" which denotes over-reading.

The question may be raised whether or not "p" is the true expression of the limitation of the 35-mm. film for interpreter

"A". The answer is in the negative, because included in the above percentage is a certain factor which does not measure the limitation of the 35-mm. technic, but which is due to errors involved in any human activity such as the interpretation of x-ray films. If the same person should read the same group of 14- by 17-inch films for a second time, experimental study has shown that he does not consistently select the identical films which he called positive on the first reading. It becomes necessary, therefore, to obtain a quantitative expression of the "individual error of interpretation." This is accomplished by obtaining from interpreter "A" a second reading of the standard films after a reasonable lapse of time. This second reading when correlated with the first reading furnishes a second percentage, " P_1 ", obtained by dividing one-half the number of films on which there was disagreement in the first and second readings, by the total number of films called positive either on the first or second reading. This percentage " P_1 " may be considered an estimate of A's "error of interpretation," which is independent of the technic. For practical purposes it may be stated that the under-reading error of interpreter "A" which is due to the 35-mm. technic is the difference between the two percentages "p" and " P_1 ".

If the positive films are further classified into more detailed diagnostic categories or if analysis is to be based on the detection of specific lesions rather than on the total positive films, the arithmetic computations become more involved but the general procedure is essentially the same as has already been outlined.

Proceed one step further with this illustration. Suppose that the two sets of films are read by an additional interpreter "B". This practice of having more than one interpreter is a necessary part of the investigation because the purpose of the study is not to determine the performance of any particular reader but to obtain an evaluation of the general performance of a group of qualified interpreters with a given technic. It is necessary to obtain the interpretations of several readers in order to predict the performance of a general group.

The inclusion of the interpretations of reader "B" with those of "A" introduces an additional type of variation which may be termed "inter-individual variation" as distinguished from "intra-individual variation" of a single person, as has been discussed. To begin with the two percentages, "p" and " P_1 " are obtained for reader "B", representing respectively the percentage positives missed on the 35-mm. and the individual error of interpretation for reader "B". In general the percentages will be different from those found for reader "A". The degree of variation in the per-

percentages for the two readers is in itself an important factor in the evaluation of the technics. Again it becomes necessary to separate the variation which is a physical or objective part of the technic from that which is human or subjective.

A comparison of the interpretations of readers "A" and "B" on the standard 14- by 17-inch celluloid films furnishes a crude measure of the "inter-individual variation" found on the standard. A similar measure is obtained for the "inter-individual" differences between "A" and "B" in interpreting 35-mm. films. These, when studied in conjunction with "intra-individual variations" of "A" and "B," furnish a quantitative description of the performance of the two readers on the technic in question.

The same method applies when the number of technics, the number of readers, and the number of classifications of "positive" films are increased. The pertinent constants furnished by this method of study may be summarized as follows:

1. *"Inter-individual" variations in reading the standard.*—These are obtained by comparing the interpretations of the different readers on a group of standard 14- by 17-inch celluloid films.
2. *"Inter-individual" variations for each of the technics under investigation.*—These are obtained by comparing the interpretations of the different readers for each of the different technics.
3. *"Intra-individual" variations in reading the standard.*—These are obtained by comparing two independent readings of each interpreter of the same standard 14- by 17-inch celluloid films.
4. *Individual scores for each technic for each reader.*—These are obtained by comparing the "under-reading" and "over-reading" of each reader for each technic with the standard 14- by 17-inch film readings. (This measure should be studied in conjunction with the "intra-individual" variations as obtained in 3.)
5. *"Inter-individual" variations of the scores of the different readers.*—These are obtained by a comparison of the scores obtained in No. 4 and should be studied in conjunction with the inter-individual variations as found in Nos. 1 and 2.

The analyses described are not the only data obtained from the comparative study of x-ray technics. The study also furnishes data which may be used to distribute the x-ray findings into as many different patterns as there are readers labeling a film "positive." If there are five interpreters, the films may be distributed in five different groups: Those selected as positive by all 5, 4, 3, 2, or by only 1 reader. It is obvious that greater reliability can be placed on the judgment of 5 or 4 readers than on that of a single reader. Comparison of these patterns for the different technics provides another method of measuring relative efficiency. A tech-

nic on which there is great disagreement among the readers is not so efficient as one which tends to yield a high proportion of uniform interpretations.

In the analysis of the films that have been "missed" by the various technics, the determination of patterns is useful. It is possible to analyze the readings according to whether positive films were missed by all 5 readers, by 4 of them, or by only one.

Study of these patterns makes it possible to single out the most useful measure to indicate the relative efficiency of the different technics. This measure may be obtained as follows: Select only the films which a majority of the readers (3 out of 5), or all the readers, have called positive on the 14- by 17-inch celluloid film. Determine the number of such "positive" films which were missed by a majority of the readers on each of the other technics. The ratio of the number that was missed by a majority of interpreters on a given technic, to the number that was called "positive" by a majority of readers on the standard-size films, may be considered as the least number that will be missed by this technic, under optimum conditions. This ratio is to a large degree independent of "inter-individual" and "intra-individual" variations; therefore it can be used to assign the relative maximum efficiencies

It is apparent from the foregoing that the definitive analysis involved in a comparative study of various technics of mass radiography includes many difficult and elaborate operations. Probably it is too much to expect that thorough analyses will be made in all studies, although such a practice is strongly recommended. It becomes necessary for each writer to present his basic data in such a way that any interested reader may elaborate on the analysis if he so chooses. The best way to accomplish this is to publish as an appendix to the report of a study, a complete list of all cases which were read as "positive" by one or more readers on one or more technics, and to define specifically and describe what is meant by a "positive" film, including if possible pictorial examples. This appendix should include for each of these "positive" films the particular readings of all readers on each of the technics. From such data, detailed analytic studies can be made, and specific studies summarized on a comparable basis.

It is hoped that this presentation of methodology in comparative chest x-ray studies will assist investigators in the field of research to contribute more meaningful studies to the medical literature on the subject. Definitive results drawn from such studies will immediately help to improve public health methods in the use of x-ray examinations, the most effective tool in tuberculosis control today.

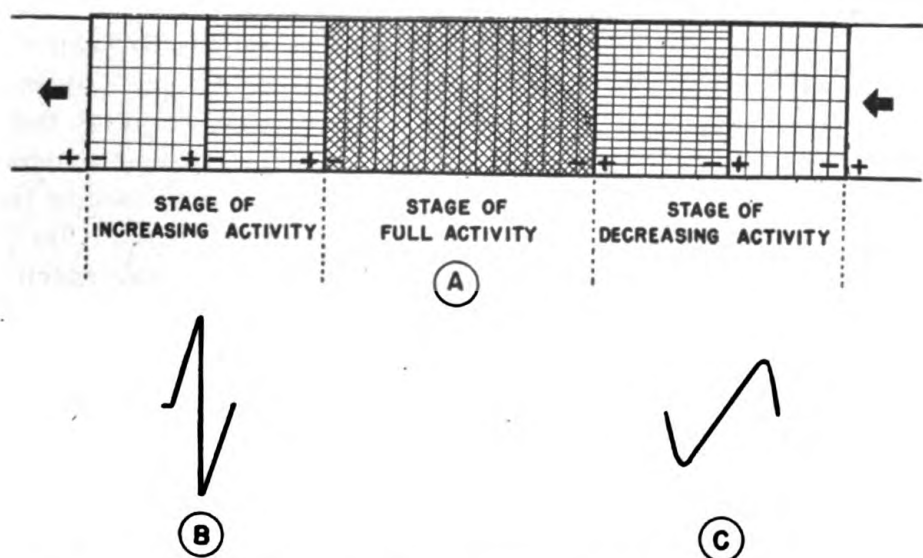
MECHANISM OF T DEFLECTION IN THE PRECORDIAL ELECTROCARDIOGRAM

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Direct and precordial leads have gained increasing importance during the past decade and have contributed much to our understanding of the electrocardiogram and to its clinical value. Wilson and his associates (1) recently reviewed the subject. These authors demonstrated a close relationship between precordial leads and direct leads taken from the underlying ventricular surface, first pointed out by Kraus and Nicolai in 1910, and showed that the significance of the QRS deflections in these leads is fairly well understood. Similar knowledge, however, is not available for the S-T segment and T deflection. In this report an effort will be made to analyze these parts of the precordial electrocardiogram. Certainly such knowledge is requisite to an understanding of their mechanism in indirect leads.

An ingenious explanation of the T deflection in a simple strip of cardiac muscle was presented by Macleod in 1938 (2). He reported experiments performed on the uninjured auricle of the Louisiana bullfrog and showed a close agreement between the



1. The spread of the activation process through a strip of cardiac muscle from right to left.

actual electrograms obtained and synthetic electrograms plotted from assumed electrical changes in a hypothetical strip of activated heart muscle. Because of this agreement Macleod concluded that his assumptions were correct.

Figure 1 illustrates Macleod's theory. It represents a strip of heart muscle which has been stimulated at the right end and in which the active process is progressing to the left, divided into three phases which represent increasing activity, full activity, and decreasing activity. At the extreme left a potential difference is shown at the junction between active and resting muscle. The active muscle is negative with relation to the resting muscle ahead of it. The stage of increasing activity is pictured as a series of doublets with the negative phase to the right of the positive phase.

Within the zone of full activity no potential difference is found. Where activity is decreasing, the muscle at the left is negative and that to the right less active and, therefore, relatively positive. An exploring electrode placed above the central portion of such a muscle strip would record a diphasic curve during the period of increasing activity (fig. 1B) and a second diphasic curve during the period of decreasing activity which is opposite in direction to that written by the first zone (fig. 1C).

By varying the length of the muscle strip, the relative lengths of the three zones, and the position of the exploring electrode, Macleod was able to plot theoretic electrograms which resembled closely those actually obtained from comparable regions of the frog's auricular muscle. He showed that the electrograms could be adequately explained as the product of two diphasic waves, opposite in phase. The first diphasic wave is termed the accession wave and includes the QRS deflections. The second diphasic wave is termed the regression wave and includes the S-T segment and T deflection. Macleod made no effort to correlate the electric changes described with physicochemical events in the myocardium. Only a single electric event is assumed to be present, and both the accession and regression waves are attributed to the passage of this electric change.

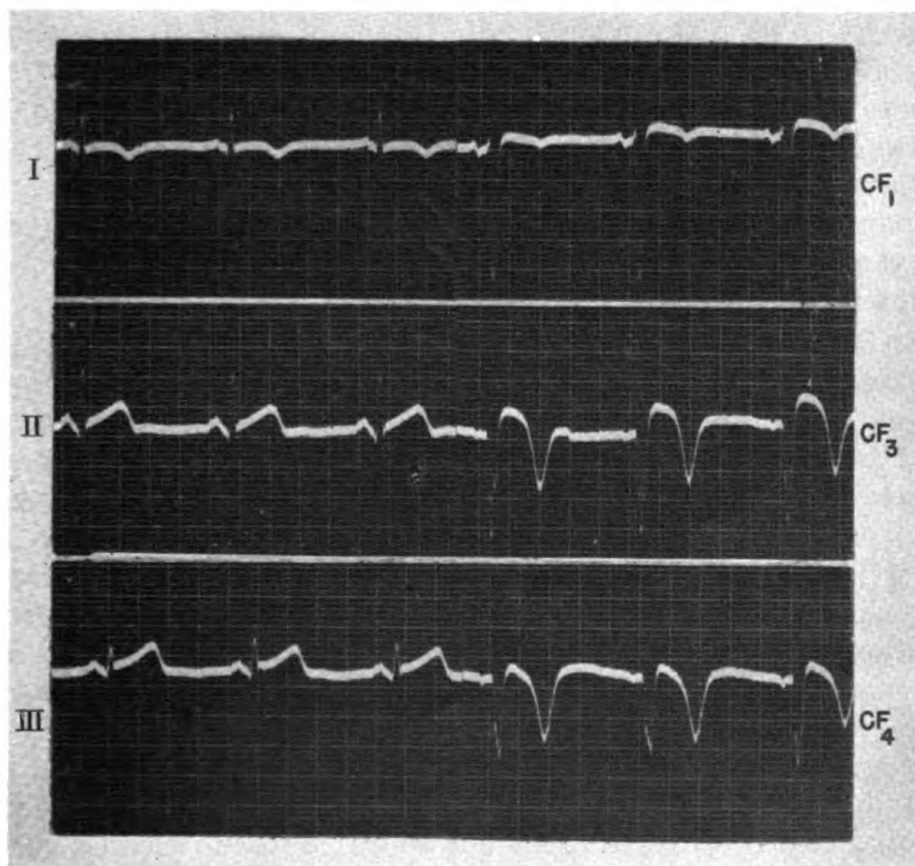
When an attempt is made to apply Macleod's theory to the electrocardiograms obtained in precordial leads of humans, certain difficulties arise. In the first place, Macleod's studies involved a simple strip of auricular muscle in which the conditions simulated those in a single muscle fiber. Obviously an exploring electrode placed directly on the ventricular epicardium represents a summation of the effects in many muscle strips, and a precordial lead introduces other factors which have to do with the distribution

of potential changes from the heart surface to the chest wall.

These facts notwithstanding, the QRS deflections in precordial leads have been analyzed with sufficient accuracy to permit a very close agreement between theoretic and actual curves. The same type of deductive reasoning should be applicable to the S-T segment and T-wave.

Wilson and his associates have demonstrated that the precordial leads, like the direct leads, show a large abrupt deflection which was found to coincide with the activation of the muscle in contact with the exploring electrode. This deflection has been termed "intrinsic" and is directed upright with the electrocardiograph connected in standard fashion, i.e., an upright deflection is recorded when the exploring electrode is positive. The other deflections of the QRS complex have been termed "extrinsic deflections" and have been attributed to the excitation of muscle more distant from the exploring electrode.

The intrinsic deflection represents the spread of an excitation wave from the endocardial surface to the pericardium. When the heart muscle in contact with the exploring electrode is inactive, the electrode records the potential changes of the adjacent ven-



2. Electrocardiogram in a case of acute cardiac infarction.

tricular cavity. If this description of the accession wave is accurate, one would expect to find a negative component in the regression wave to correspond to the upright intrinsic deflection in accordance with Macleod's hypothesis.

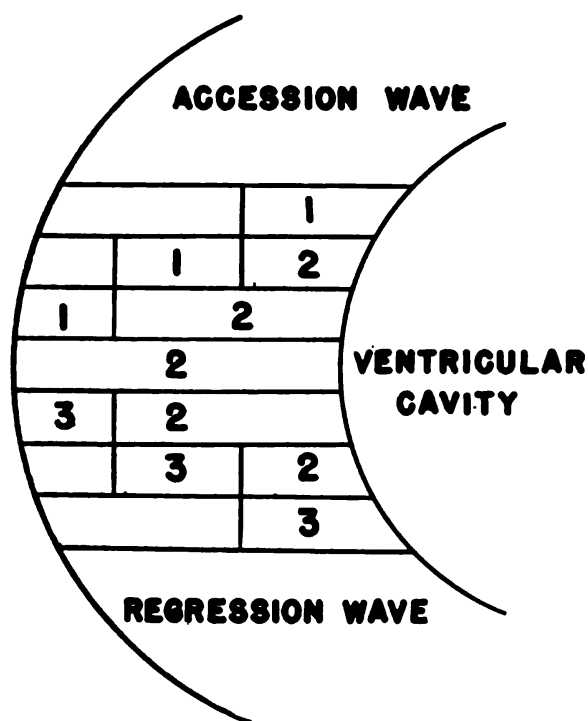
A study of the precordial leads of normal electrocardiograms indicates that the directions of the S-T segment and T deflection are entirely unrelated to the directions of the QRS components. The T deflection is directed upright, as is well known, in leads CF_2 , CF_3 , CF_4 , CF_5 , and in the comparable CR and CL leads, and cannot be predicted from the configuration of QRS. No negative components are found to correspond to the large upright intrinsic deflections. A similar situation is found when one studies the potential changes of the ventricular cavity by using the auricle or an anterior wall infarct as an electric hole. Figure 2 presents an electrocardiogram taken in a case of acute cardiac infarction involving the anterior ventricular wall. In the precordial leads of this figure the main deflection of the accession wave is negative and the T deflection is likewise negative.

One can conclude that the regression wave in precordial leads does not bear the relationship to the accession wave that Macleod found in his simple muscle strip. The direction of the T deflection appears to be independent of the shape of QRS. This conclusion is confirmed by the well established fact that anoxemia (3) and drugs such as digitalis and epinephrine (4) can cause marked changes in S-T, T without comparable changes in QRS. Our knowledge of the chemical changes associated with the cardiac impulse, meager as it is, also favors the view that the secondary wave of the electrocardiogram is not wholly dependent on the primary wave.

It is established that two sets of chemical reactions take place in heart muscle during activity (5). One probably involves the breakdown of phosphocreatine and the production of lactic acid and takes place in the absence of oxygen. The second probably involves a resynthesis for which oxygen is required. The assumptions that both sets of chemical reactions are associated with electric changes, that the differences of potential produced are opposite in direction, and that the accession and regression waves of the electrocardiogram correspond to these changes, appear to be in accord with the evidence at hand. The fact that the regression wave may be changed by anoxemia and drugs, while the accession wave is not, supports this hypothesis.

It has been shown above that the regression wave in the precordial electrocardiogram cannot be attributed to electric changes opposite in direction to those that produce the accession wave and

spreading in the same direction, i.e., from the endocardial to the pericardial surface. Furthermore all available evidence suggests that the electric changes during recovery are opposite in direction to those that occur during excitation.



3. A schematic representation of the spread of the accession and regression waves, showing that the primary wave begins in subendocardial and the secondary wave in subpericardial muscle. 1 represents the stage of increasing activity or excitation; 2 the stage of full activity; and 3 the stage of decreasing activity or recovery.

Obviously, the possibility that the regression wave may begin in the subpericardial layer and spread toward the endocardium must be considered. Figure 3 schematically illustrates such a sequence of events. The excitation wave (zone 1) begins in the subendocardial layer and spreads toward the pericardium. The duration of activity (zone 2) is pictured as being shorter in the subpericardial than in the subendocardial muscle. As a result, the secondary wave (zone 3) starts in the former and spreads in a direction opposite to that of the primary wave.

Since more active muscle is relatively negative to less active muscle, both primary and secondary waves may take the same direction, the muscle toward the electrode being relatively less active than muscle farther away, during both parts of the electrocardiogram. That anoxemia and drugs can change the duration of activity, and therefore the direction of spread of the regression wave and the direction of S-T, T appears not unlikely.

The hypothesis presented, then, permits an acceptable explanation of the facts that S-T, T may be positive when QRS is positive, and that S-T, T may change its shape and direction without change of QRS. This hypothesis is supported further by the

probability that systole begins in the subendocardial muscle and that diastole begins in the subpericardial muscle. If activity terminates more quickly beneath the pericardium than in the deeper layers, the duration of systole varies accordingly.

SUMMARY

1. Although much is known concerning the mechanism of QRS in precordial leads, the mechanism of the T deflection is poorly understood.

2. An attempt to apply Macleod's analysis of the T deflection in a simple strip of cardiac muscle to the precordial electrocardiogram presents certain difficulties.

3. The assumption that the duration of activation varies in different parts of the myocardium permits an adequate explanation of the T deflection in direct and precordial leads.

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STREPTOMYCIN FOR RELAPSING FEVER AND WEIL'S DISEASE

Streptomycin was found to exert a considerable protective effect on experimental infections produced with *Borrelia novyi* and *Leptospira icterohaemorrhagiae*. Streptomycin was relatively less effective than penicillin in the treatment of these two types of infection. It is suggested that streptomycin may be useful as an adjunct to penicillin therapy in the treatment of spirochetal infections in man.—HEILMAN, F. R.: Streptomycin in the treatment of experimental relapsing fever and leptospirosis icterohaemorrhagica (Weil's disease). *Proc. Staff Meet. Mayo Clin.* 20: 169-176, May 30, 1945.

FIBROUS DYSPLASIA—A "CYSTIC" LESION OF BONE

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Cystic lesions of bone, single or multiple, present a difficult diagnostic problem for the roentgenologist, especially when they occur in young patients who show no evidence of hyperparathyroidism. If following biopsy of such a rarefying lesion the pathologic report is "fibrocystic disease," then the clinician handling the case has a bewildering array of diseases that might satisfy these criteria. Some order has been brought out of this chaos by the studies of Jaffe and of Lichtenstein (1) (2) (3) (4) who have recently correlated the histologic, roentgenographic, and clinical features of a "cystic" bone lesion which they call "fibrous dysplasia."

The case to be reported here is that of a 20-year-old veteran who showed no evidences of hyperparathyroidism but in whom a solitary "cyst" of the femur was demonstrated by roentgenography, and biopsy of the lesion showed the changes called "fibrous dysplasia." The disease is of importance to the armed forces because of its occurrence in youth and its tendency to cause pathologic fracture.

Case report.—The patient, 20 years of age, entered a Naval hospital complaining of a dull aching pain in the right thigh of 6 months' duration. The pain was aggravated by walking or rainy weather. Three months prior to entry he had been discharged from the Army because of these symptoms.

The patient fractured the left femur at the age of 6 or 7 years, and had walked with a slight limp since then. His father had "ankylosis" of the spine and was "bent over."

Physical examination showed no essential abnormalities except for a slight limp in walking and there were no areas of cutaneous pigmentation or evidences of endocrine dysfunction. Erythrocytic, leukocytic, and differential blood counts were normal. Urine examination and Kahn test yielded negative results. The blood serum calcium was 11.7 milligrams percent, and the serum phosphorus 3.1 milligrams percent.

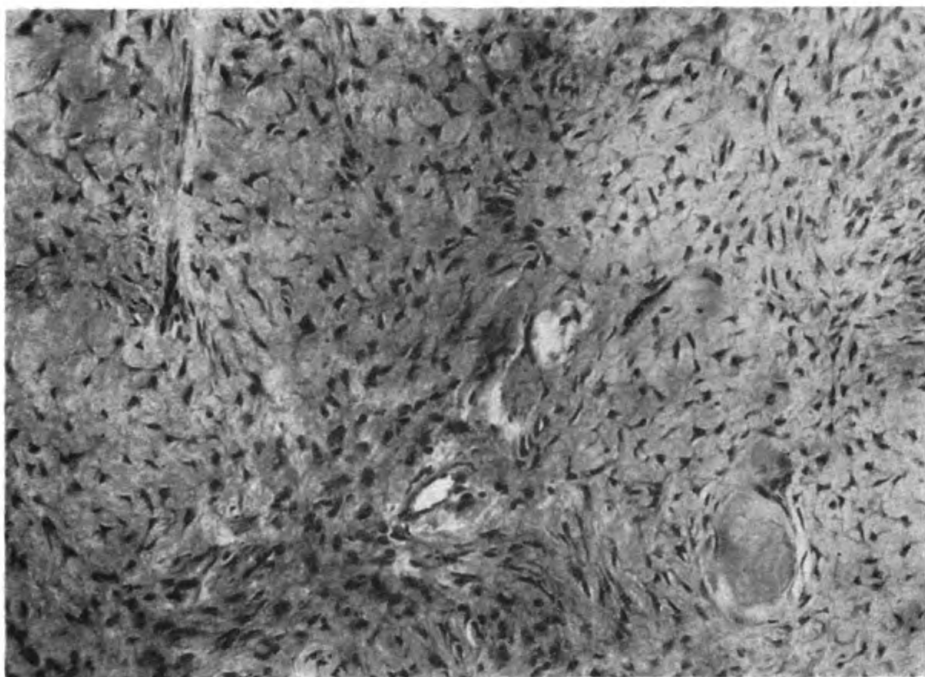
Roentgen-ray examination of the right hip disclosed evidence of an expansile, bone-destructive lesion involving the intertrochanteric portion of the femur and the base of the femoral neck (fig. 1). There was evidence of



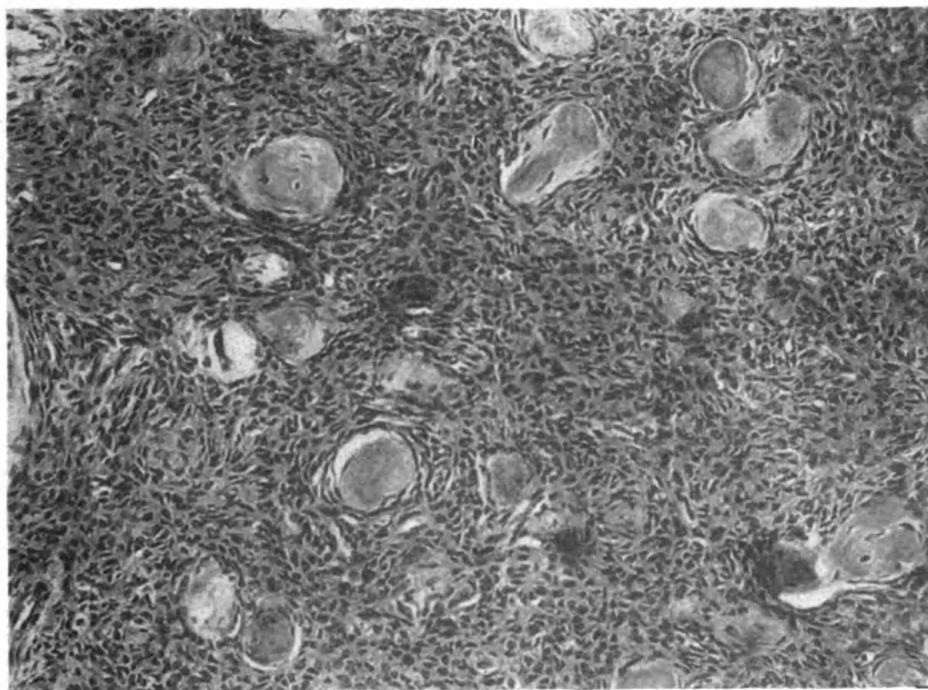
1. Roentgenogram showing "cystic" area involving the intertrochanteric portion of the femur and the base of the femoral neck.

localized thinning of the cortex, the periphery of which was still intact. In addition there was a mottled, somewhat circular area of increased density in the central portion of the cyst-like appearing area. There was no evidence of either osseous or periosteal reaction adjacent to the lesion, which had the x-ray appearance of a benign neoplasm or a cyst. Roentgen-ray examination of the left foot, left hip, skull, chest, and femora showed no abnormalities. The roentgenologist suggested benign enchondroma, giant cell tumor, or solitary bone cyst as possibilities.

Surgical biopsy of the area obtained innumerable pieces of tissue varying in size from 1 mm. to 2 cm. in diameter. All pieces contained bone and what appeared to be granulation tissue. The histologic description was (figs. 2 and 3):



2. Biopsy from the "cystic" area showing the replacement of normal bone by loosely arranged fibrous connective tissue and an occasional spicule of primitive bone. X 310.



3. Biopsy from the "cystic" area showing many small spicules of non-lamellated atypically calcified, metaplastic fiber bone. X 310.

"Multiple sections through the decalcified pieces of biopsy material show in all the same histologic picture, namely, relatively small atypical bone trabeculae, many apparently undergoing resorptive changes, surrounded by a dense fibrous-like stroma made up of stellate-shaped nuclei, widely separated from one another by a faintly pink staining, homogeneous, intercellular substance. An occasional giant cell having only a few nuclei is noted along some of the edges of the bone lacunae. Vascularity is inconspicuous and the blood spaces have intact endothelial lining. No changes indicative of sarcoma can be made out. No cartilage is identified . . ."

The pathologic report stated that the findings were consistent with those of localized osteitis fibrosa. A later review of the slides confirmed the diagnosis of fibrous dysplasia.

The lesion was exposed and was found filled with cartilaginous-appearing tissue. The "cyst" was curetted and filled with osteoperiosteal bone chips from the right tibia. Very little bleeding was encountered. Eighteen months after operation roentgen re-examination of the intertrochanteric portion of the right femur showed excellent filling-in of the former cavity by newly formed bone, with only a small radiolucent zone remaining proximally. At this time the patient had full function of the leg, and no subjective complaints.

COMMENT

For many years it had been recognized that multiple bone cysts could be found in the absence of hyperparathyroidism (4), but that such lesions might be accompanied by extraskeletal diseases was probably first pointed out by Weil in 1922 (5). He described the case of a 9-year-old girl, with a sexual and skeletal development of 15 years, who was said to have menstruated since infancy. There were present abnormal cutaneous pigmentation and bone changes of osteodystrophia. The child had sustained eight fractures during her life. A few scattered cases appeared up to 1934 when Goldhamer (6) gave a comprehensive report of a similar case.

In 1937 Albright et al. (7) reported 5 such cases and collected 16 others. They stated that there is a syndrome that is characterized by the triad of (1) the bone changes of "osteitis fibrosa," (2) cutaneous pigmentation, and (3) endocrine dysfunction with precocious puberty in females.

In 1938 Lichtenstein (8) presented studies of 8 cases showing "cystic" bone lesions. He stated that the microscopic findings were identical with those of the bone lesions of the syndrome emphasized by Albright et al. He believed that his cases represented a mild phase of the same disease and used the term "polyostotic fibrous dysplasia."

Bone "cysts" similar to those described by Albright et al. (7) (8) were found in 1942 by Lichtenstein and Jaffe (2) in their 23 patients. They emphasized that this disease was frequently mild

and that only with the severe skeletal changes, generally occurring in infants or young adults, were the extraskeletal lesions present. They were able to find 90 cases, including their 23, in the literature, all showing bone lesions with the same specific features. These cases were listed under 33 different diagnoses, generally some form of "osteitis fibrosa," "osteodystrophia fibrosa," "osteitis fibrosa cystica disseminata," or "fibro-cystic disease of bone." Lichtenstein and Jaffe called the disease "fibrous dysplasia of bone" in the belief that it was a skeletal developmental anomaly. They believe it to be second in frequency only to multiple exostoses in the systematized anomalies of bone development.

Clinical features.—The disease occurs predominantly in childhood or early adult life, and more frequently in females. The average age at onset of symptoms is 10 years. Pain is the predominant symptom, and deformity, limp, and pathologic fracture are the most common signs produced by the lesion. Occasionally the disease is asymptomatic and found only incidentally during roentgen-ray examination (as in Adams's (9) 59-year-old patient). The affected bone upon roentgen examination shows a rarefying lesion that is generally called a "bone cyst." There may be thinning of the cortex, broadening or expansion of the bone, or secondary deformities such as bowing or pathologic fracture. Spotty calcification may give a trabeculated appearance to the cyst.

Of 87 cases reviewed (2), the lesion was restricted to one bone in 15 cases. Most of the patients showed only one or a few bones involved, and the striking feature was the unilateral distribution. In 29 of the cases in which extensive involvement of many bones occurred, the same predominance of unilateral localization was found. Even those cases with severe involvement of many bones showed one side to be more implicated than the other. The bones of the lower extremities, especially the femur and tibia, were said to be most commonly involved, followed in frequency by the humerus and radius, and then by the skull, pelvic bones, ribs, and phalanges. Also reported involved were the vertebrae, scapula, clavicle, metacarpals, and fibula.

Of the extraskeletal features, 32 of 90 cases showed cutaneous pigmentation, the most common nonosseous abnormality. Albright et al. (8) state that the pigmentation has a tendency to occur on the same side as the bone lesions, and that sacrum, buttocks, and upper spine are the areas most frequently involved.

Twenty of the 90 patients have shown evidence of endocrine dysfunction—19 females with precocious sexual maturation and one boy with hyperthyroidism. Other features that have been

reported in association with the bone lesions are: Premature skeletal growth and maturation; multiple arteriovenous aneurysms; coarctation of the aorta with rudimentary kidney; hypertension; and a history of icterus gravis neonatorum. However in 23 cases with mild or moderate skeletal involvement, only 2 had cutaneous pigmentation and 2 had precocious menstruation. As a rule only those cases showing severe osseous involvement have extraskeletal changes.

Blood chemistry.—Serum calcium is generally normal or only slightly elevated. Calcium excretion is usually normal, although a case of increased calcium excretion has been reported (8). Serum phosphorus is normal. Phosphatase values are normal or slightly increased, as occurred in three of Lichtenstein's four patients in whom the test was performed. A disturbance of lipid metabolism and a decrease in carbohydrate tolerance have been reported (10).

Pathology.—Gross examination of the affected bone shows a replacement of spongy bone and a filling of the marrow cavity by grayish-white, rubbery tissue, sometimes described as gritty, and frequently likened to cartilage because of its consistency. Histologically it is seen that the medulla and bone have been replaced by fibrous tissue through which are scattered trabeculae of poorly formed primitive bone. The connective tissue is composed of a loose, whorled arrangement of small spindle cells with an occasional area of collagen or myxomatous tissue. Rarely foci of thin-walled blood vessels or islands of hyaline cartilage are seen. The trabeculae are of varying size and shape, have no mature lamellation, and are atypically calcified, metaplastic fiber bone. They show very few osteoclasts. No lesion has been reported as showing malignant changes.

It is to be emphasized, as Jaffe and Lichtenstein have, that although the lesions are called "cystic" because of their absence of bone and resulting radiolucency, *they are not true cysts* and are actually composed of fibrous tissue which completely occupies the area.

Differential diagnosis.—One of the chief problems in diagnosis is to distinguish the disease from hyperparathyroidism. Six patients with this disease had been surgically explored and two received roentgen-ray therapy in the mistaken belief that they had hyperparathyroidism. The relatively normal calcium metabolism and the specific histologic picture of fibrous dysplasia should readily differentiate these two diseases.

Skeletal enchondromatosis (Ollier's disease), xanthomatous bone lesions, malignant disease, Paget's disease, multiple mye-

loma, and localized lesions such as unicameral bone cyst, giant cell tumor, chronic osteomyelitis, enchondroma, eosinophilic granuloma, or other rarefying lesions enter the differential diagnosis. Biopsy of these areas is the surest method of diagnosis; in most of these cases histologic examination will determine the nature of the disease (1) (2) (3) (4) (11).

Etiology.—The disease was believed at first to be a unilateral form of von Recklinghausen's disease. Albright et al. suggested an endocrine dysfunction but later decided that a disseminated neurologic disease was more likely and that changes in the vicinity of the third ventricle could account for the precocious sexual disturbances. Jaffe and Lichtenstein thought that the disease was one of developmental anomaly of bone-forming mesenchyme, and that the few cases of other abnormalities represented a concomitant anomaly not necessarily a feature of the disease process. Thannhauser (12) has recently revived the concept that the disease is closely allied to von Recklinghausen's neurofibromatosis.

Treatment.—It is important to emphasize that biopsy is obligatory before any treatment is instituted, regardless of how "typical" of any lesion the roentgenographic picture may appear. If the lesion occurs in a nonweight-bearing bone, is small, and gives no symptoms, it can safely be left alone once diagnosis by biopsy has been made. Curetting of the "cyst" and filling with autogenous bone chips is recommended for small lesions giving symptoms. If the lesion is large and occurs in a weight-bearing limb, the insertion of a massive autogenous bone graft has been advised.

The case presented here represents one of the group having only a single or few bone lesions. As is to be expected from the mildness of the process, no extraskeletal abnormalities were found. The roentgenographic findings were typical, with replacement of bone throughout most of the lesion but with increased density where the spicules of abnormal bone were numerous. Histologically there were the usual findings of replacement of bone by fibrous tissue, which in some areas (fig. 2) is extensive. In other areas (fig. 3), newly formed, atypically calcified, different sized spicules of nonlamellated bone are seen in the fibrous tissue. Consistent with all other cases reported, there was no evidence of malignancy in the sections examined. The patient did well postoperatively and 18 months later showed radiographic evidence of healing.

ACKNOWLEDGMENT: The authors wish to acknowledge the kindness of Dr. H. L. Jaffe and Dr. Louis Lichtenstein in demonstrating to us, from their extensive material, the features of this disease.

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EOSINOPHILIC GRANULOMA OF BONE

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Granulomas of unknown cause originating in bone have been recognized for many years, and have been known under various terms. In 1929 Finzi (1) reported a myeloid lesion with eosinophilic infiltration occurring in the frontal bone of a 15-year-old boy. Schairer (2) in 1938 described two instances of osteomyelitis of the skull with eosinophilic response, both occurring in young boys 9 and 10 years of age. These reports may be presumed to be examples of what we now consider eosinophilic granuloma of bone.

The first authenticated reports of this condition were made almost simultaneously in 1940 by Otani and Ehrlich (3) and Lichtenstein and Jaffe (4). Several terms have been applied to this disease, and the same clinical and pathologic condition has been described under such headings as destructive granuloma of bone by Green and Farber (5); solitary granuloma of bone by Otani and Ehrlich; and eosinophilic granuloma of bone by Lichtenstein and Jaffe, Mallory (6), Kernwein and Queen (7), and others, and it is under this latter term that the condition is best known. From reports occurring in the literature to the present, certain salient features are evident which have made this somewhat perplexing disease a definite clinical and anatomic entity. The principal points, as observed by us to date, may be summarized briefly:

1. It is a benign, destructive lesion affecting principally the skeletal system, with a predilection for the ribs and skull.
2. It is no longer considered a solitary lesion, but rather frequently affects multiple osseous areas.
3. It has a unique histologic picture, consisting of large accumulations of histiocytes, eosinophilic cells, principally leukocytes, and giant cells. These giant cells are large, acidophilic and multinucleated, frequently containing phagocytosed eosinophilic granules, neutral fat droplets, and debris. In addition there are large

cells of apparent osseous origin, probably osteoclasts, which are relatively few in number.

4. It has in roentgenograms a suggestive but not entirely diagnostic appearance. It involves primarily the interior of the bone, expanding and frequently eroding the cortex, and sometimes invading the adjacent soft tissues. This erosion also occasionally results in pathologic fractures.

5. The condition is practically limited to children and young adults, especially males.

6. Surgical treatment is the most desirable procedure, although the disease is amenable to x-ray therapy. Spontaneous healing, however, is known to occur, unassisted by any other therapy.

7. Although not proved, it is thought to be associated in some manner as a stage of Schüller-Christian disease and Letterer-Siwe disease, representing a different expression of the same basic lipoid disorder.

8. The cause is obscure, but is most probably the result of some infectious agent. The part played by trauma, as stressed by several authors, does not seem to be substantiated. Some obscure virus infection has also been postulated. As yet the pathogenesis has not been established.

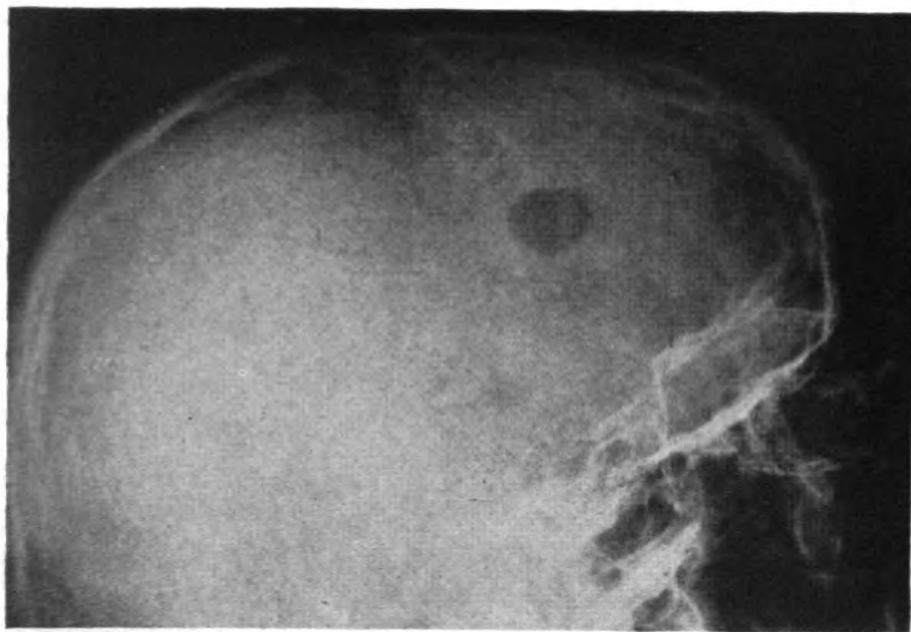
9. Recognition of the benignity of the lesion will result in a more conservative therapy in certain obscure bone lesions.

10. There may be a relatively long interval between the recognition of the initial lesion and appearance of subsequent lesions.

Case reports in the medical literature have been relatively few in number, although this condition is more widespread than is apparent. Recognition of the entity will lead to the clarification of many bone and soft-tissue lesions. Our two case reports are unique in that the symptoms in both instances became acute under actual combat conditions in Central Pacific invasions. No history of trauma, however, could be elicited in either instance.

CASE REPORTS

Case 1.—A lieutenant, age 25 years, was admitted on 9 July 1944 complaining of pain and soreness in the right temporal region. Two months previously he had noticed a swelling in this area which gradually became sore and tender to the touch. These findings became progressively worse, although the size of the mass was variable, increasing at times, and at other times showing regressive tendencies. All these findings gradually receded, and at no time did he seek medical care until the Saipan campaign, when the soreness again became acute. On admission to the hospital he was complaining of pain and swelling in the right temporal area, with localized tenderness in that region. There was some right-sided headache, but no visual or central nervous system disturbances were demonstrated.



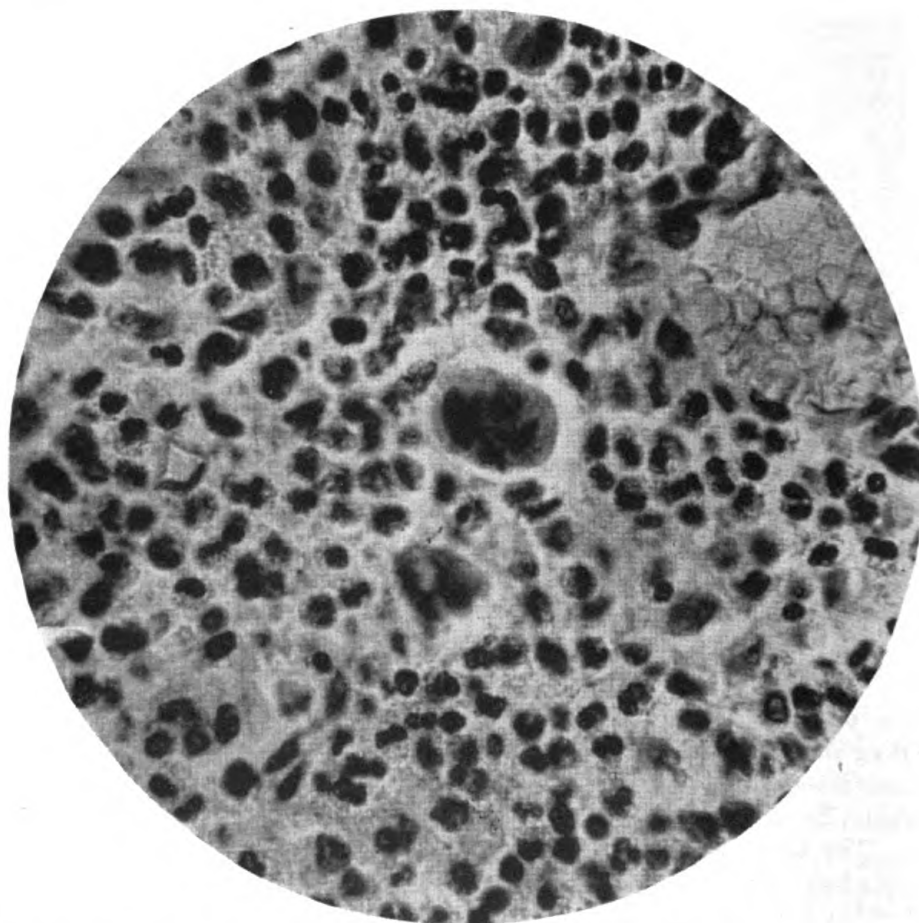
1. Case 1. Roentgenogram showing characteristic punched-out destructive lesion of skull. This is a favorite site for development of the condition. No other bone lesions were observed in this patient.

The physical examination showed no essential abnormalities except the swelling and tenderness over the area described. Laboratory work showed a normal blood count and normal urine, with no Bence-Jones protein demonstrated. The sedimentation rate was moderately accelerated (15 mm.) in 1 hour. The blood Kahn test was negative, and blood calcium, phosphorus and phosphatase were all within normal limits. A roentgenogram showed an oval-shaped defect of the skull, approximately 2 by 1.5 cm. in size (fig. 1), and no involvement of any other areas.

Operation: A small skin flap exposed the anterior portion of the right temporal muscle which was incised and reflected, exposing the abnormal area. A soft mass presented itself and this was separated readily from the irregular border of the bone. The undersurface was attached to the dura, but was easily removed.

On gross examination the mass measured 1.8 by 1.2 cm. and appeared yellowish-gray in color and streaked with blood. It was soft in consistency and moderately vascular. Microscopically it was composed of dense sheets of cells intermixed with areas of necrosis. The cells consisted of numerous pale histiocytes of various sizes, with both uninuclear and multinuclear cells in evidence. Large numbers of eosinophilic cells were seen, mostly leukocytes with a predominance of polynuclear forms. Giant cells of two types were observed; a few acidophilic osteoclastic cells and large numbers of multinucleated acidophilic cells. Both the histiocytes and the multinucleated giant cells were observed to contain eosinophilic granules, neutral fat droplets, and debris. Many eosinophilic granules were also seen free in the tissues, apparently from broken-down cells with disruption of the cell membrane (fig. 2). Mitotic figures were not observed and there was a relatively small amount of fibrous tissue in the lesion. The vascular supply was moderate.

This patient experienced an uneventful recovery and was returned to duty on 7 August 1944.



2. Case 1. The deeply staining cells are eosinophilic in nature. Note the typical multinucleated giant cells. Phagocytosed granules may be seen in the giant cells and histiocytes. Eosinophilic granules may also be observed free in the intercellular spaces.

Case 2.—A Marine private, age 21 years, was brought to the hospital on a stretcher on 11 February 1944. He had noticed the first symptoms of the disease 1 year before when some pain developed in the right lower part of the chest, gradually extending around to the back. This pain was accentuated at night. Some paresthesia developed in both legs and he noted that he stumbled occasionally. These findings did not prevent him from carrying on his regular duties during this time, and he was in sufficiently satisfactory physical condition to take part in the Marshall Islands invasion. When landing on the beach in that assault, however, his legs became weak and there was a feeling of numbness down both legs, extending up to his hips.

On admission to the hospital he complained of generalized weakness of both legs accompanied by a loss of sensation. Physical examination showed no appreciable wasting of his lower extremities, although muscle tone was greatly increased and deep reflexes exaggerated. There was a loss of pain, touch, and position sensations in both lower extremities. This extended upward to the

tenth thoracic vertebra where a sharp line of demarcation was seen.

Spinal puncture showed a complete block in the lower thoracic region. Lipiodol injection revealed this block to be at the upper level of the eleventh thoracic vertebra.

Laboratory study revealed normal findings, both in the blood count and urinalysis. Bence-Jones protein was not present. Blood chemistry examinations, including calcium, phosphorus, cholesterol, and phosphatase were all within normal limits. A chest roentgenogram showed a mass in the lower right side extending from the eighth to the tenth thoracic vertebra. The body and transverse process of the ninth thoracic vertebra showed erosion.

On 17 February 1944 a laminectomy was done, extending from the eighth to the tenth thoracic vertebra. Under the ninth, a mass was encountered which extended down to the right side of the eleventh vertebra. The mass was lobulated, soft and only slightly hemorrhagic. The major portion of the soft-tissue growth was removed, but the bone lesion was not disturbed.

The granuloma measured 5 by 3 cm. in size and appeared as a soft, spongy, moderately hemorrhagic tumor, yellowish-gray in color. Microscopic examination revealed a picture somewhat similar to that observed in the former report. The presence of histiocytes and eosinophilic cells was the most prominent feature, and there were numerous characteristic multinucleated giant cells. Phagocytosed pigment granules were observed in the histiocytes and



3. Case 2. This photomicrograph shows the appearance of certain areas observed in the more chronic lesion from case 2. Although the mass was composed of large cellular sheets, numerous areas displayed fibrosis and other evidence of chronicity, not evident in case 1. These bone giant cells differ from those shown in figure 2.

giant cells. This lesion differed from the former in a manner to be expected due to the longer period of existence of the condition. Neutral fat droplets were observed in larger amounts and osteoclastic giant cells were seen in larger numbers, even though the examined mass was removed from the juxtaposed soft tissue. In addition fibrous tissue was increased in quantity, as is well shown in figure 3.

This patient received a moderate amount of x-ray therapy postoperatively (total dosage 2,242 r units). He showed marked improvement in his symptoms and was evacuated to the States on 17 May 1944. Recent x-ray studies of the area show satisfactory healing. From latest reports on this patient, his condition is considered good. Neurologic symptoms have largely disappeared and he is able to walk without difficulty.

COMMENT

Etiology.—No satisfactory explanation has as yet been ascribed as the cause of this condition. From the history and histologic examination of the tissues, it would appear to be due to some infectious agent. Although trauma has been cited by some authors, there is nothing in the histories of these two patients or in those of three others seen by one of us (P. M.) to substantiate this claim. The opinion that the lesion may represent a virus granuloma, as put forward by Jaffe and Lichtenstein, was not substantiated by them later (8). It is unlikely that the disease will eventually be considered neoplastic, for reasons which are self-evident.

The theory that this condition may represent a stage in the basic lipoid disorder closely related to Schüller-Christian disease and Letterer-Siwe disease cannot be corroborated from the studies made on these two reported cases. Neither could it be refuted, and the pathogenesis of this condition must still be considered as undetermined.

Pathology.—As the name applied infers, the most characteristic finding in this disease histologically is an infiltration by eosinophilic cells, most of which are leukocytes, and this feature is constant regardless of the age of the lesion. The origin or significance of these can hardly be speculated upon, although Lichtenstein and Jaffe have shown some eosinophilic myelopoiesis in one instance, as demonstrated in sternal bone marrow studies. These eosinophilic cells have been noted in all reported cases, and have been observed both as multiple dense foci and diffusely scattered throughout the lesion. Sheets of blotted-out cells undergoing necrosis are seen in both the recent and older lesions. Fibrosis, on the other hand, is more characteristically observed in the older and more chronic conditions, contrasted in cases 1 and 2.

The presence of histiocytes is another feature in all lesions; they

may vary in size, shape, and nuclear structure. The highly characteristic giant cells are another constant finding. The more commonly observed multinucleated forms constitute one of the three pathognomonic structures, along with the eosinophilic cells and histiocytes. Phagocytosed particles are always present. Eosinophilic granules are seen free in the tissues and engulfed by both the giant cells and smaller histiocytes. Other particulate matter may also be seen.

In the more chronic lesions, neutral fat droplets are found within these cells in larger amounts, and for this reason certain observers are of the opinion that this condition is primarily an upset in lipid metabolism. Necrosis and hemorrhage are both features of the histologic process, especially the former. As stated previously, fibrosis is present to a small degree in the acute lesions, and to a much larger degree in the older processes. This is accentuated in those lesions that have definitely been traumatized, particularly when pathologic fractures have occurred.

Grossly the removed granuloma is yellowish-gray in color, moderately vascular, and usually blood streaked. The tissue is soft in consistency, becoming firmer with the progression of fibrosis.

Clinical findings.—The subjective and objective findings observed in the disease are naturally dependent upon the site of the lesion or lesions. Occasionally the first indication of trouble may be a spontaneous fracture through the eroded bone. Pain is the most common complaint, occurring over the affected part, usually associated with soreness and tenderness (case 1).

The first report showing primarily neurologic signs and symptoms was made by Osborne, Freis, and Levin (9). In our second case the most severe and alarming findings were neurologic in nature. In children, in whom involvement of the upper part of the femur is not uncommon, a very frequent finding is pain over the affected area, usually accompanied by limitation in movement. A limp may be the first recognizable abnormality.

If multiple bone lesions are present, the clinical problem becomes progressively more complicated, not only in treatment but in diagnosis as well. It must be kept in mind also that there may be a variable interval, extending up to years, between the recognition of the original condition and the appearance of subsequent lesions. Because of this, adequate follow-up studies should be carried out in all patients. Fever is not a constant finding.

Laboratory findings.—Apart from the biopsy diagnosis, no characteristic laboratory findings have been seen. The sedimentation rate may or may not be prolonged. There may or may not

be a leukocytosis, with or without a slight eosinophilia. Bence-Jones protein is not encountered.

X-ray findings.—The x-ray examination is suggestive of the disease but not entirely diagnostic. The lesion is seen originating in the interior of the bone extending peripherally, expanding and sometimes eroding the cortex. The process may extend out into the soft tissues as was illustrated in case 2. In the skull the lesions appear as punched-out, discrete areas, while in the long bone, rarefaction is usually evident. In the more long-standing lesions, deposition of new bone is frequently seen in the cortex. No apparent reports have been made to the present on bones of the hand or foot. Pathologic fractures may sometimes occur.

Therapy and prognosis.—Surgery is the procedure of choice, not only because the lesion responds very well to this treatment, but also because it affords the best method of diagnosis through tissue studies. This may or may not be followed by subsequent irradiation. X-ray alone is less effective therapy, although beneficial. Spontaneous healing is known to have occurred in some patients, and because of this some authors believe that the place occupied by radiation therapy is still in doubt. In our second case we felt that x-ray therapy was a distinct addition to the treatment.

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DIPHTHERIA OUTBREAK AT A LARGE NAVAL TRAINING CENTER¹

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During two late summer months of 1944 an outbreak of diphtheria occurred in three companies of one camp at this large Naval training center. In the entire outbreak, 24 patients and 16 carriers were admitted to the dispensary or hospital between 19 August and 7 October. The epidemic was complicated by an outbreak of streptococcal disease in these same companies. The course of the epidemic was studied in detail and all men in these companies were followed daily. Valuable bacteriologic and immunologic data were obtained on a large proportion of the affected and nonaffected men. The results of this study emphasize some interesting and practical facts in the epidemiology and control of a diphtheria outbreak in a large military organization.

¹Enlisted personnel who assisted in this study were: Edward Warmanen, Chief Pharmacist's Mate; W. D. Harrison, Pharmacist's Mate, first class; C. G. Johnson, Pharmacist's Mate, first class; Peter Packet, Pharmacist's Mate, first class; L. V. Grussendorf, Pharmacist's Mate, first class; F. W. Elias, Pharmacist's Mate, second class; D. J. Linder, Pharmacist's Mate, second class; and H. M. Stevenson, Pharmacist's Mate, third class, all of the Naval Reserve.

The first patient came to sick call from his barracks on 19 August and was transferred directly to the Naval hospital with the provisional diagnosis of diphtheria. The second reported to sick call from the same barracks on 24 August, complaining of sore throat. He was admitted to the area dispensary with the diagnosis of tonsillitis. Four days later the true nature of his illness was suspected and he was sent to the Naval hospital. During this 4-day period, while this second man was in the sickbay, 7 men from the three subsequently affected companies were admitted to the dispensary with respiratory infections. Most of these men were returned to duty before 1 September, the time when the presence of two cases of diphtheria on the Center prompted an investigation by the regimental medical officers and the Epidemiology Unit. This sequence of events made possible two foci of infection: (1) The sickbay, and (2) the company barracks.

As soon as the presence of diphtheria was determined, all possible contacts in the barracks and sickbay were isolated, examined, and cultures were taken. This initial examination revealed in Company 761, one advanced and two early cases of clinical diphtheria, one diphtheria carrier, and one suspected case of diphtheria which later developed scarlet fever. In Companies 781 and 796, which were only involved because of exposure of some of their men in the sickbay, one diphtheria carrier was found in each company. Each day thereafter examination of all recruits in the three companies was made in the barracks and any person exhibiting evidence of pharyngeal or nasal disease had cultures taken and was transferred to the Naval hospital or to the sickbay for isolation and observation until the nature of the illness could be determined. Furthermore cultures for diphtheria were done at weekly intervals on all recruits in the involved companies. In the sickbay all patients were examined twice daily and all patients admitted with respiratory infections had cultures taken for diphtheria.

A definite diagnosis of diphtheria was difficult during the first 48 hours of illness because of the presence of many cases of streptococcal throat infections, such as pharyngitis, tonsillitis, and scarlet fever in the regiment, and particularly in the companies involved. A number of cases exhibited concurrent infection with *Corynebacterium diphtheriae* and a hemolytic streptococcus.

All cases of diphtheria exhibited a similar symptomatology: Abrupt onset, relatively high fever, severe sore throat, chills, and generalized aching. On examination the patients showed an inflamed throat and frequently a membrane over the tonsillar or

pharyngeal area. Although the abruptness of onset, chills, aching, and degree of fever more often suggested streptococcal disease than diphtheria, these findings could not be relied upon because patients who bacteriologically proved to have diphtheria frequently had the same clinical picture as those who were suffering from hemolytic streptococcus infection alone. In the cases where both diseases were concurrent, the clinical picture was that of streptococcal disease. As a result all throat infections in the involved companies had to be considered as diphtheria until proved otherwise.

The following examples illustrated the clinical difficulties encountered: (1) One patient with clinical diphtheria and a diphtheria carrier developed a concurrent scarlet fever; (2) a diphtheria carrier later developed diphtheria; (3) ten recruits were ill two or more times during the period of isolation; (4) throat cultures were frequently positive for both *C. diphtheriae* and beta hemolytic streptococci. All of the cases were relatively mild to moderate, and there were no deaths or serious complications.

Inasmuch as the close contact of men in berthing may well have been a factor in the rapid spread of both diphtheritic and nondiphtheritic respiratory infections, men in Company 761, where the diphtheria was most prevalent, as soon as possible were dispersed over two decks in one barracks. The entire company was billeted on a single deck until 10 September. On 11 September the company was dispersed over two decks of the same barracks and remained there until graduation on 7 October.

Although contacts were obviously frequent between men in the barracks, it is interesting that men in nearby bunks frequently developed the same type of infection. This indicates that berthing contacts are of great importance in the spread of illness. It is also of interest that subsequent to the dispersal of the recruits of Company 761 to two decks on 10 September, after taking into account incubation periods, relatively less spread of respiratory infections occurred than in the two companies not dispersed. Three cases of diphtheria occurred after the dispersal of the men to two decks, but within 3 days of the time of the move.

It is probable, therefore, that these cases were contracted before the move and they should therefore be re-allocated to the period from 1 to 10 September. When this re-allocation is made and the two cases occurring in August are excluded, the diphtheria rate for the first 10 days of September was 79.1 per 1,000 per week and for the next 27 days 16.3 per 1,000 per week. This occurred despite the fact that a large number of diphtheria susceptibles remained in the company. It is probable, but not possible to prove,

that the dispersal of men was an important factor in decreasing illness.

Because of the complicating streptococcal infection, each recruit was given 2 gm. of sulfadiazine daily from 7 September to 5 October, in an effort to control this form of infection. This had no apparent effect on either the diphtheria or the streptococcal outbreak.

During the course of the outbreak, all available men in Companies 761 and 781 were tested for Schick reaction and a history of previous immunization with either toxin-antitoxin or toxoid was obtained. The relation of the Schick test to immunization and to development of either diphtheria or the diphtheria-carrier state is given in table 1, and the relation of the history of immunization to the development of clinical diphtheria or the diphtheria-carrier state is given in table 2.

TABLE 1.—*Relation of Schick test to history of immunization and development of clinical diphtheria or diphtheria carriers*

	Schick test negative		Schick test positive		Total	
	Number	Percent	Number	Percent	Number	Percent
No previous immunization . . .	83	68	39	32	122	100
Previous immunization	21	37	36	63	57	100
Cases of diphtheria	3	57	4	43	7	100
Diphtheria carriers	1	33	1	67	3	100

TABLE 2.—*Relation of history of immunization to development of clinical diphtheria or diphtheria carrier state*

		Diphtheria		Diphtheria carriers	
		Number	Percent	Number	Percent
Immunized	57	1	1.8	0	0
Not immunized	122	6	4.9	3	2.5

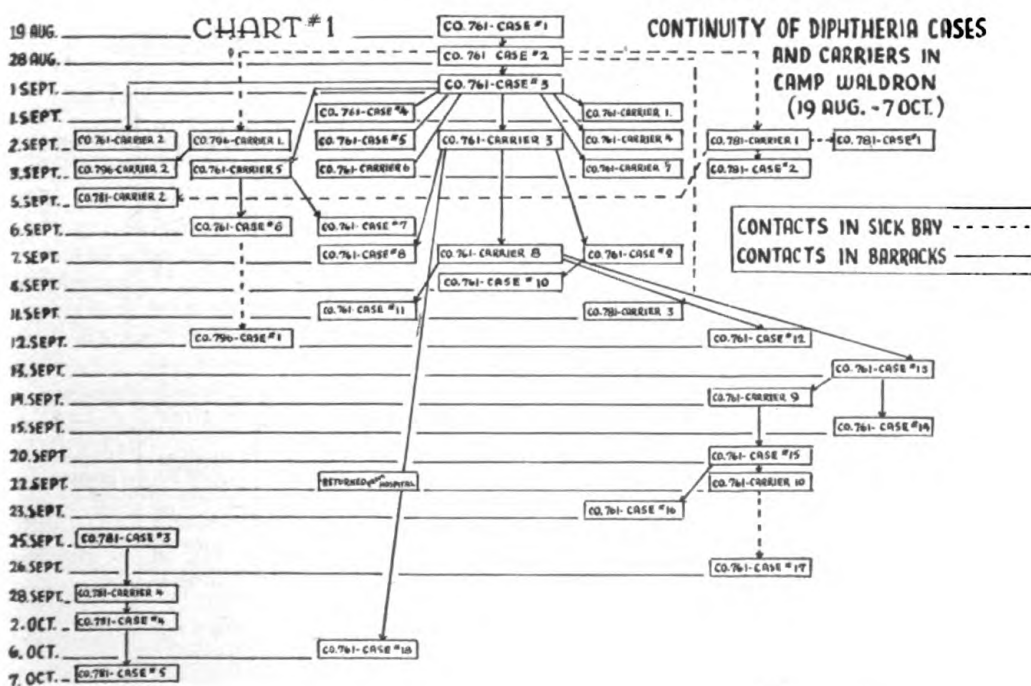
Granting that the histories were adequate, the technic and reading of the tests correct, the quality of the Schick material good, and the diagnosis of diphtheria accurate, the following conclusions are justified, even on this small group: (1) A high proportion of the recruits were positive to the Schick test; (2) previous immunization protected some but not all men from diphtheria, as judged by the Schick test; (3) previous immunization protected some but not all men against diphtheria in the face of a diphtheria outbreak, as judged by occurrence of clinical diphtheria; (4) a negative Schick test is not a guarantee against the development of clinical diphtheria.

TABLE 3.—Morbidity rate per 1,000 per week for diphtheria, diphtheria carriers, streptococcal disease and other respiratory illnesses for the time affected companies were in camp

Com- pany num- ber	Aver- age daily popu- lation	Weeks in camp	Diphtheria		Diphtheria carrier		Streptococcal disease		Other respira- tory diseases		Total illness	
			Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
761....	104	15	18	12.4	10	6.9	50	34.4	6	4.1	84	57.7
781....	109	13	5	3.5	4	2.8	61	43.3	17	12.0	87	61.8
796....	107	12	1	.8	2	1.6	53	41.4	7	5.4	63	49.2

The distribution of cases and carriers of diphtheria and admitted cases of streptococcal disease are given in table 3. This table shows that all three companies were heavily affected by illness during their training period. During this period of training between 60 and 80 percent of the average strength of these companies were admitted to the dispensary or hospital with some form of respiratory disease.

It was noted that there was a tendency for more than two-thirds of the bacterial infections (diphtherial and streptococcal diseases) to occur after the sixth week of training, whereas catarrhal fever, which is more often of virus causation, occurred earlier. Most of the diphtheria occurred in the ninth, tenth, eleventh, and twelfth weeks of training in Company 761, as did the streptococcal infections. The continuity of cases is given in the chart. It will be noted that sickbay contacts were of great importance in the beginning, but after adequate isolation measures were taken, they became less common.



Practically 95 percent of the two companies tested came from towns or cities in the northern states. It is well known that these states contain a large adult diphtheria-susceptible population. Present experience, as judged by the explosive character of this outbreak and unusually high incidence of positive Schick tests, seems to confirm this fact.

Bacteriology.—During the period of observation, throat cultures were taken from all suspected persons and from the normal recruits in the three affected companies while they were in their barracks or in the sickbay, in outgoing unit or in the hospital. Furthermore all patients admitted with respiratory illness, and medical officers, nurses and corpsmen in the dispensary to which the patients were first admitted were similarly cultured. The cultures, with the exception of those taken from patients while in the hospital, were examined by the epidemiology laboratory. In the main the agreement between the hospital and epidemiology laboratories was excellent. Differences could usually be accounted for in the error inherent in the cultural methods. One man, for instance, in whom diphtheria organisms originally were found in both laboratories was sent to the hospital. After he had had three negative cultures at the hospital, he was returned to his area where three more cultures were reported negative by the epidemiology laboratory. Despite this, after developing a cold, he infected a bunk mate with diphtheria and was found to have a positive culture at this time.

TABLE 4.—*Distribution of cultures for Corynebacterium diphtheriae from September 1 to November 2*

	Total cultured	Number positive	Percent positive
Barracks.....	944	29	3.1
Sickbay.....	660	14	2.1
Outgoing unit.....	269	0	0
Total.....	1,873	43	2.3

TABLE 5.—*Relation of throat cultures for hemolytic streptococci to clinical diagnosis*

	Total cultured	Number positive	Percent positive
Nondiphtheritic respiratory infections.....	21	21	100
Diphtheria carriers.....	9	7	78
Diphtheria cases.....	16	6	38

A total of 1,873 cultures were examined by the epidemiology laboratory.² The relation of the percent positive to the place in which the cultures were taken is shown in table 4. The highest percent of positives was found in the barracks, indicating that examination of men in the barracks is of great importance in finding men with positive throat cultures.

In a number of patients suffering from respiratory illness, cultures were likewise taken for hemolytic streptococci. The relation of the presence of streptococci to clinical diagnosis is given in table 5. This table shows that concurrent infections with both the streptococcus and diphtheria bacillus were relatively common, and that practically all patients with nondiphtheritic respiratory infections had throat cultures positive for hemolytic streptococci.

Unfortunately no suitable laboratory animals were available for virulence studies so that all positive cultures had to be considered virulent from the standpoint of controlling the outbreak. Laboratory studies indicated that the organism in question was the intermedius strain which is in keeping with the relatively mild to moderate course of the cases clinically.

Control measures.—During the outbreak, rigorous control measures were instituted which were highly successful in preventing the spread of infection beyond the three companies. In two of the three companies these measures prevented spread even in the barracks.

Case finding: (1) Affected companies were examined daily by medical officers; (2) cultures were taken from anyone showing evidence of nose and throat disease; (3) weekly throat cultures of all recruits within the affected companies were done; (4) cul-

² Making of Löffler slants: One of the difficulties often encountered in studying diphtheria in the field is the difficulty in making good Löffler slants. The following method was found to be of considerable value:

Material:

- (1) A 10-pound dental plaster container with flat sides and a large mouth.
- (2) Standard Navy autoclave.
- (3) Absorbent cotton.

Method:

- (1) A slanted layer of absorbent cotton is placed in the bottom of the plaster can.
- (2) Löffler slants are made in the usual manner and placed in the can. Lumps in media may be avoided by placing dehydrated media in mortar. A small amount of water is added. A pestle is used to mix thoroughly. The remainder of indicated amount of water is added.
- (3) The can is sealed by inserting a sheet of paper under the lid. The can should be air tight before placing in the autoclave.
- (4) The slants are autoclaved 30 minutes at a pressure of 15 pounds after which the steam valve is closed. The escape or vacuum valves are not to be opened and only after the steam-pressure gage registers zero is the can removed from the autoclave.

tures for *Corynebacterium diphtheriae* were taken of all patients from any company within the regiment who were admitted to the dispensary sickbay with respiratory illness; (5) twice daily examination of all sickbay patients was made.

Isolation.—All persons suspected of diphtheria or of being carriers were immediately isolated in the dispensary in a special ward until the results of cultures could be obtained. Patients with apparent clinical diphtheria were sent to the hospital even before culture results could be obtained, in order to assure early treatment and prevention of cross-infection.

Diphtheria patients and carriers were not released from the hospital until at least from 3 to 5 cultures for diphtheria organisms were negative, but even in the presence of repeated negative cultures, such persons were not allowed with other companies. On return from the hospital the recovered patient or carrier was returned to his company until the time of graduation of that company. If the patient's company had graduated at the time of his return, he was kept in isolation until he could be graduated and sent on leave. This was usually accomplished within 24 hours, even though the man's recruit training was not complete. Upon return from leave such persons were isolated until a final culture could be taken and proved negative.

All contacts in sickbay and barracks were examined as described elsewhere in this paper. The barracks were quarantined and all food brought to the men in the barracks. Sick call was likewise held in the barracks.

A company was released from quarantine when (1) no cases of diphtheria had been found in the company for 1 week, and (2) cultures taken a week apart on all men were negative. Barracks contacts were minimized by spreading the normal recruits over two decks.

Serum.—In order to prevent the further development of cases in Company 761, the use of diphtheria antitoxin in 5,000-unit doses in persons having positive Schick test was considered. But this was not done for the following reasons:

1. Preliminary skin tests for sensitivity with available serum even in small diluted doses, .005 cc. each, gave a high proportion of positive results.

2. Those not sensitized might be made sensitive to horse serum.

3. The development of serum sickness in a large number of men would probably occur, even in those showing a negative skin test to serum.

4. Although this would stop the spread of actual disease in the company, it would not assure the prevention of the spread of the

carrier state, or prevent infection spreading to other companies.

5. Passive immunization would be effective no longer than from 10 to 14 days.

6. The diphtheria was not clinically severe.

7. Although objections 1, 2, and 3 could have been eliminated by the use of despeciated antitoxin from which a large proportion of sensitizing serum protein had been removed or modified, by the time this was obtained the outbreak was under control.

SUMMARY

1. An outbreak of diphtheria in a large Naval station is described. Twenty-four clinical cases of diphtheria and 16 carriers were found limited to three companies.

2. Contacts in barracks and in sickbay were responsible for the cases. The outbreak was complicated by a concurrent epidemic of streptococcal disease.

3. The cases of diphtheria were mild to moderate in severity, and apparently caused by the intermedius type. No deaths or serious complications occurred.

4. A large proportion of the men came from the northern states and the majority had positive Schick reactions.

5. A history of previous immunization for diphtheria did not guarantee a negative Schick test or the prevention of clinical diphtheria. Three cases of diphtheria developed in men with known negative Schick tests.

6. Rigorous control of isolation of the patients and affected companies prevented further spread of the infection.



TOXICOLOGY OF DDT

DDT is tolerated in fairly large amounts when administered as single or repeated doses. Toxic levels are not easily reached when dilute solutions suitable for insecticidal purposes are employed. Danger to health is likely to arise only from careless use of concentrates. Prolonged contact with undergarments impregnated with DDT has not produced any local or general disturbance in human subjects. DDT poisoning is characterized by nervous symptoms and the development of severe damage to the liver. Premonitory symptoms and changes in the blood picture give warning of the onset of the toxic stage.—CAMERON, G. R.: Toxicity of 2,2-bis (*p*-chlorophenyl) 1,1,1-trichlorethane (D.D.T.). Brit. M. J. 1: 865-871, June 23, 1945.



DOCTOR TYPES

There are many types of doctors just as there are many types of lawyers and other professional folk. Briefly we may group the doctors under the following types:

1. The Sherman-tank type of man, whose voice will be heard through all the corridors for a distance of three or four floors. He generally is in a good humor, but his conversational tone is as quiet as that of an auctioneer's voice, and seldom soothing to his patients.

2. There is the quiet, genteel, mousy type of doctor who cannot be heard and hardly seen.

3. Then we have the untidy sort of man, who goes through the halls smoking a pipe or cigar, or cigarette, scattering ashes not only in the halls but in the chart rooms, over the charts and more or less around the patients' rooms, unless perchance he puts his cigar or cigarette on some convenient doorstep or in the hall and goes away and leaves it.

4. There is the type who never has any set time for visiting the hospital and is just as apt to see his patients at bed-pan time, meal time, or late hours of the night. In most instances, except in cases of emergency, these visits could be arranged at a more convenient and less disturbing time for the patient and everyone concerned.

5. The ack-ack type of doctor, and for that matter, many other types of doctors are prone to tell jokes, some of which date back before the time of Confucius, and in the telling of these jokes they get rather loud and enthusiastic. This is sometimes rather disconcerting to the patient and time-consuming to the nurses, who should be busy and have little time now to listen to old jokes. Motto: "We are always glad to see our doctors, but we have no time for idle talk or old stories. If we are not busy, we should be."

6. One type of doctor who causes more or less confusion is the man who has imbibed a bit too freely before he decided to make hospital rounds. He is apt to be slow, inaccurate, noisy, and in other ways may make a nuisance of himself.—BOYD, E. F.: Relation of doctor to hospital. *Arizona Med.* 2: 167-171, May 1945.

SPRAINED ANKLES

A NEW FORM OF TREATMENT

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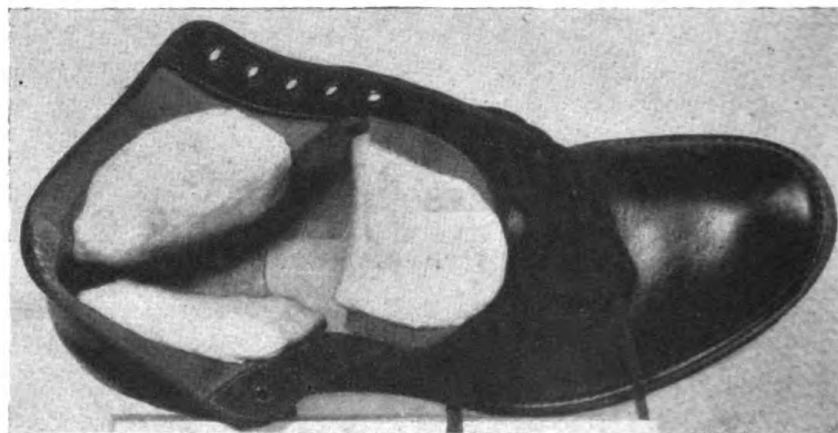
Our concepts in the treatment of ankle sprains have become modified in the past several years in at least one respect; it is now generally held that the early institution of weight-bearing serves to cut down materially the period of disability. On this point most surgeons are agreed, though it is far different from the treatment used at the turn of the century, when bed rest, hot poultices, Dover's powders, and gentle massage were the vogue. Leriche¹ and others have shown the value of early weight-bearing, made possible by injecting the painful parts with procaine hydrochloride. The healing stage is said to be shortened by this method, although some feel that the walking and not the procaine is the important factor. Injections in and about a joint are not, however, without danger of carrying infection, and they can in no way serve to protect the damaged ligaments from minor injuries during the healing period.

The author believes that these minor or subclinical injuries are not prevented by the procaine treatment and that healing is likely to be either incomplete or faulty, thus giving rise to a permanently weak ankle. It would seem, therefore, that the injection method is not an improvement upon the older and time-honored forms of strapping; yet from it we have learned the value of early walking.

Gibney² in 1895 described a method of strapping an ankle, and since that time it has enjoyed a well-deserved popularity. Even today it is considered the standard method of treatment, although it has several drawbacks: (1) The straps do not remain sufficiently tight throughout the treatment, and as they become loose, lateral motions of the ankle are permitted; (2) adhesive tape cannot be kept on the skin up to 21 days without causing a dermatitis in a large percentage of patients; and (3) the repetition of

¹ LERICHE, R.: Traitement précoce du syndrome ischémique de Volkmann par la résection artérielle dans le cas de blessure ou de rupture artérielle. *Bull et mém. Soc. nat. de chir.* 59: 746-751, May 13, 1933.

² GIBNEY, V. P.: Sprained ankle. *New York M. J.* 61: 193, 1895.



1. Note the beveled edges on the circular pads correctly placed in the boot.

strapping every third day is wasteful of both man-hours and materials.

With these points in mind, the author sought to devise a routine which would embrace the two essential principles, namely, early weight-bearing and good ankle support, and it is the purpose of this article to describe this routine and to set forth a few suggestions which will be helpful in differentiating a fracture from a sprain.

The support principle is a simple one, based on the fact that a military boot is a good splint in itself. By the addition of felt pads to the inside (fig. 1), its supporting qualities are multiplied

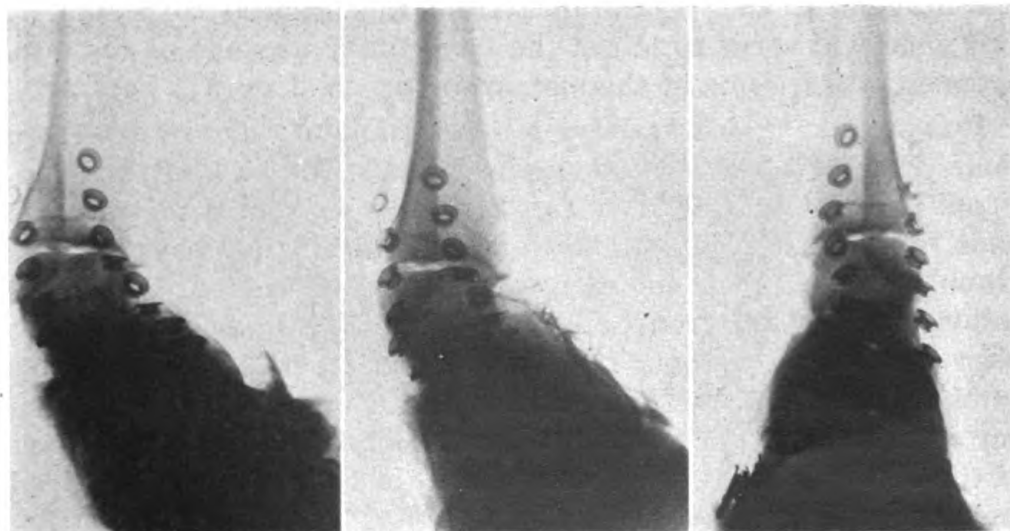


2. Front view showing the great amount of lateral support offered by this method.



3. The general contour of the boot is not disturbed. It is important that it be laced tightly.

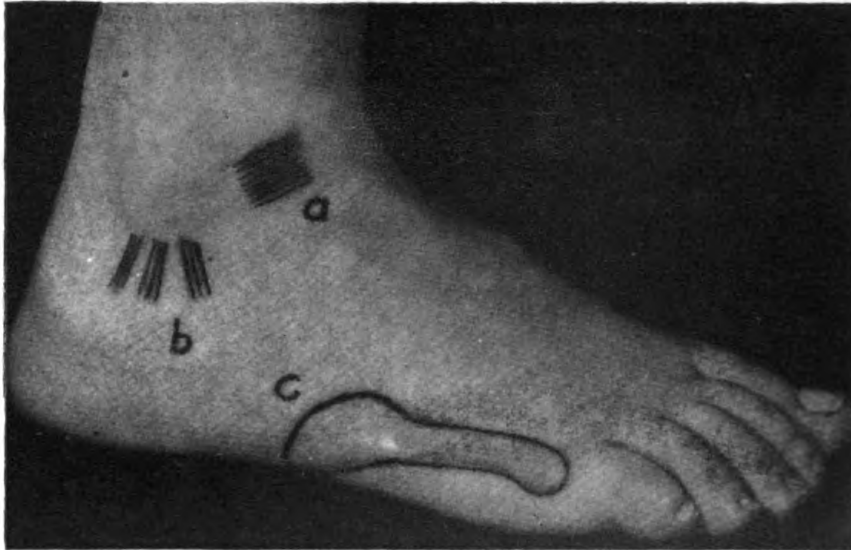
many times (fig. 2). After the pads are properly applied, the boot is laced tightly to the top eyelet (fig. 3) and the patient is instructed to walk a distance of 500 yards and to return for any adjustments that may be required. The first few steps are usually painful, the severity being in proportion to the time that has



4. X-ray of ankle taken through an unpadded Navy boot, showing amount of inversion permitted.

Taken through an unpadded Navy boot. A fresh Gibney strapping has just been applied extending up to the knee. Note the amount of inversion permitted.

Practically no inversion is permitted with the padded boot.

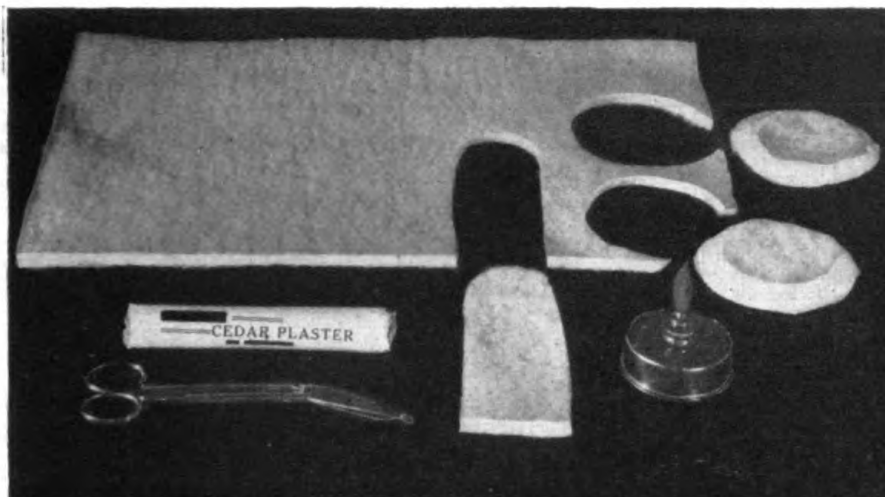


5. (a) Most common tender point in the sprained ankle (anterior tibio-fibular ligament).
(b) Lateral ligaments are less commonly sprained. A complete tear of these structures constitutes a serious lesion and requires a cast.
(c) Inversion injuries may fracture the base of the fifth metatarsal. One should routinely palpate this area.

elapsed from the injury to the time walking is begun. A little encouragement and reassurance from the hospital corpsman at this time will serve to lessen the momentary attitude of discouragement which some of the men are likely to show.

It is surprising and gratifying to see many of them return from their trial walk without the slightest limp. The bulk of these patients are sent to light duty for 48 hours, instructed to wear the pads for at least 21 days, and to return only if they have further trouble. It has been noted that about 20 per cent are likely to return, and in that group we usually find that the boots have not been laced tightly enough. A smaller percentage may require further individual care, but on the whole we are able to return our men to duty immediately with a minimum effort on the part of the Medical Corps, with a maximum of comfort to the injured man, and with an increased assurance that the ankle will be fully protected against other injuries during the healing phase.

While it would be ideal to have roentgenograms on all sprained ankles, in times like these it is mandatory that we conserve x-ray film. It therefore becomes necessary, in justice to the patient, that the clinical examination be careful and exact. It is the opinion of the author that a high degree of accuracy in diagnosis can be obtained without the x-rays if the examination is conducted along the following lines.



6. Materials and equipment used.

First, the history is important. An accident in which an impact is made with the deck, as in a fall or a jump, is more likely to result in a fracture than is the usual inversion twist of the ankle that occurs while walking, running, or lifting. Point tenderness on the malleoli suggests fracture, as does tenderness at the base of the fifth metatarsal. Second, ligamentous tenderness is characteristic of a sprain, and the most consistent location for this finding is over the anterior tibio-fibular ligament (fig. 5). Other points in the differential diagnosis are set forth in the table, and



7. Cedar plaster being applied to felt pad. An alcohol lamp is convenient for this purpose.

Differential diagnosis

	Type of injury	Swelling	Ecchymosis	Crepitus	Deformity	Tenderness	Response to ankle pads
Sprain.....	Usually an inversion twist while walking, lifting, or running.	++	0 +	0	Soft tissue only.	Ligamentous.	Improvement on walking 500 yards.
Fracture....	Usually an impact from a jump or a fall.	+++	+++	+	Bony.	Bony.	Aggravated.

it will be noted that we include as a diagnostic sign the response noted on wearing the padded boot through the first 500-yard trial walk.

TECHNIC AND MATERIALS

1. Saddle felt $\frac{3}{8}$ -inch thick. This may be purchased in large rolls, then cut into circular pieces $3\frac{1}{2}$ inches in diameter and shaved off on one side (figs. 6 and 7).

2. Cedar plaster and an alcohol lamp. The plaster is held in the flame about two seconds and dabbed on to the unshaved side of the pads. After the material is spread out over the entire surface, the sticky side is held over the flame to be reheated, then applied to the inside of the shoe in such a manner that the center of the pad corresponds to the "center" of each malleolus. A strip $\frac{1}{4}$ -inch thick is then applied to the tongue.

SUMMARY

1. The essential principles in the treatment of a sprained ankle are (a) adequate support, and (b) early weight-bearing.

2. The military boot padded with felt makes an ideal dressing for sprained ankles and is superior to other forms of treatment previously used by the author.

3. The support should be used for at least three weeks in order to insure the best healing.

NEPHROPEXY

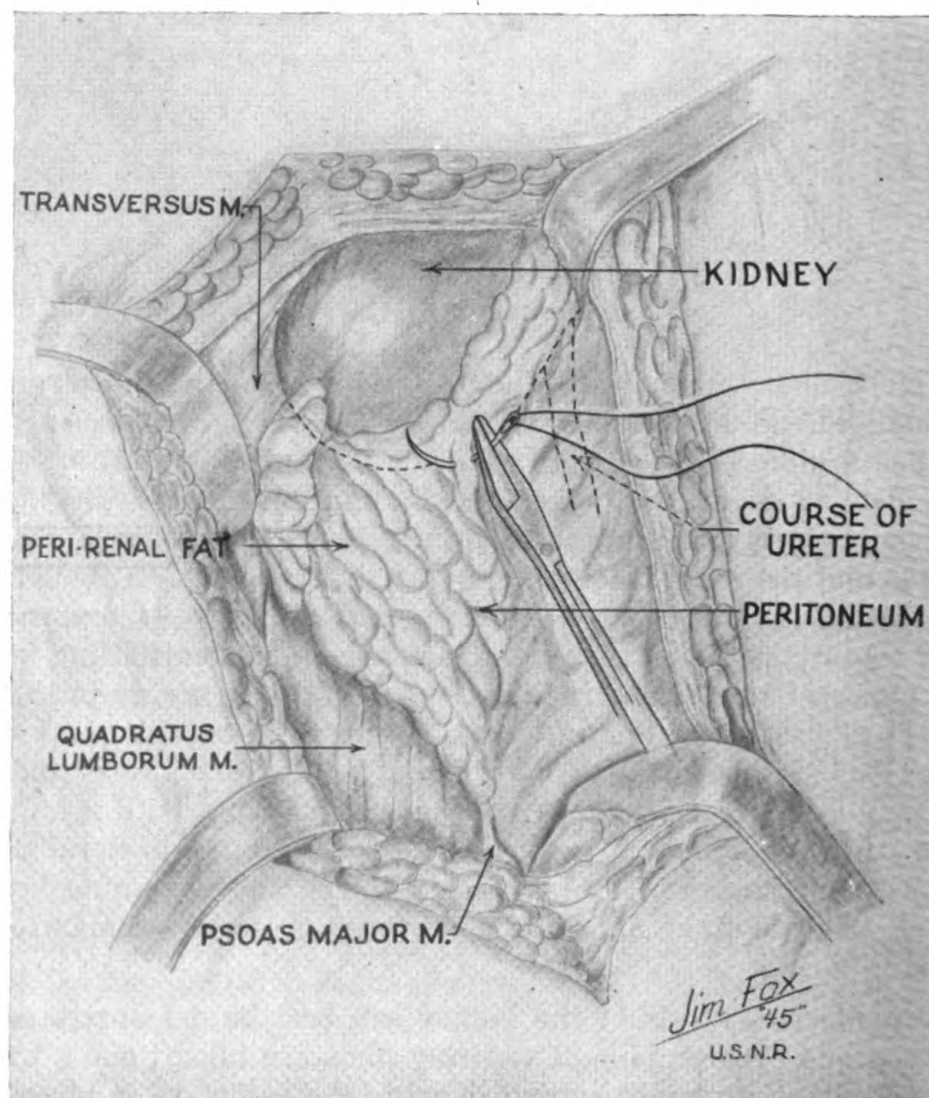
FRANCIS A. BENEVENTI

Lieutenant (MC) U.S.N.R.

Nephropexy for movable kidney, or for replacing the surgically mobilized kidney, holds an important place in urologic surgery. When a kidney moves more than the normal range of 3 or 4 cm. incident to respiration, it is termed a movable kidney. The kidney is not held in place by any distinct ligaments; it has a shallow fossa and the renal fascia offers very little support. Although the perirenal fat exerts some effect in renal support its presence is not essential. A long renal pedicle is a definite predisposing factor in ptosis. Ureteral obstruction, however, rarely occurs in the absence of fixation of the ureter, no matter how movable the kidney may be. Without obstruction there is no hydronephrosis and the patient is consequently symptomless. In patients with symptoms the ureter is found to be kinked because of peri-ureteral adhesions, aberrant vessels, or adhesive bands, and beginning hydro-nephrosis and other signs of urinary back pressure are manifested early.

Diagnosis.—Ptosis of the kidney can best be demonstrated by retrograde pyelography. Two x-ray films are taken; one a pyelogram with the patient supine showing the catheters in place and the position of the kidneys when the patient is lying down; and the other a pyelo-ureterogram with the patient in the standing position.

In nephroptosis which can be corrected by surgery, this last film will show a wide excursion of the kidney and a kinking of the ureter along with evidence of urinary back pressure such as dilatation of the ureter above the obstruction or pyelectasis. There will be a delayed emptying time of the renal pelvis, and reproduction of the loin pain when the pelvis remains distended. This is the specific pain which causes the patient to seek medical attention. In nephroptosis the usual history is that there is pain in the upright position which is relieved when the patient lies down. The use of an abdominal support in tall asthenic persons will sometimes alleviate the distressing symptoms but does not effect a permanent cure.



1. Showing the kidney being held in position by basket sling made up of edge of peritoneum and perirenal fat. Lower pole of kidney is tilted laterally to allow for better drainage of the kidney pelvis.

Types of nephropexis.—Almost all of the types of nephropexis recorded make use of the fatty and fibrous capsule of the kidney. The manner in dealing with the capsule varies; some surgeons make circular or longitudinal cuffs of the fibrous capsule and suture these to the loin incision; others suture them to the back muscles. In another type the kidney is suspended from the twelfth rib, utilizing the kidney capsule for this purpose. Suspensions with fascia lata and with ribbon-gut have also been described.

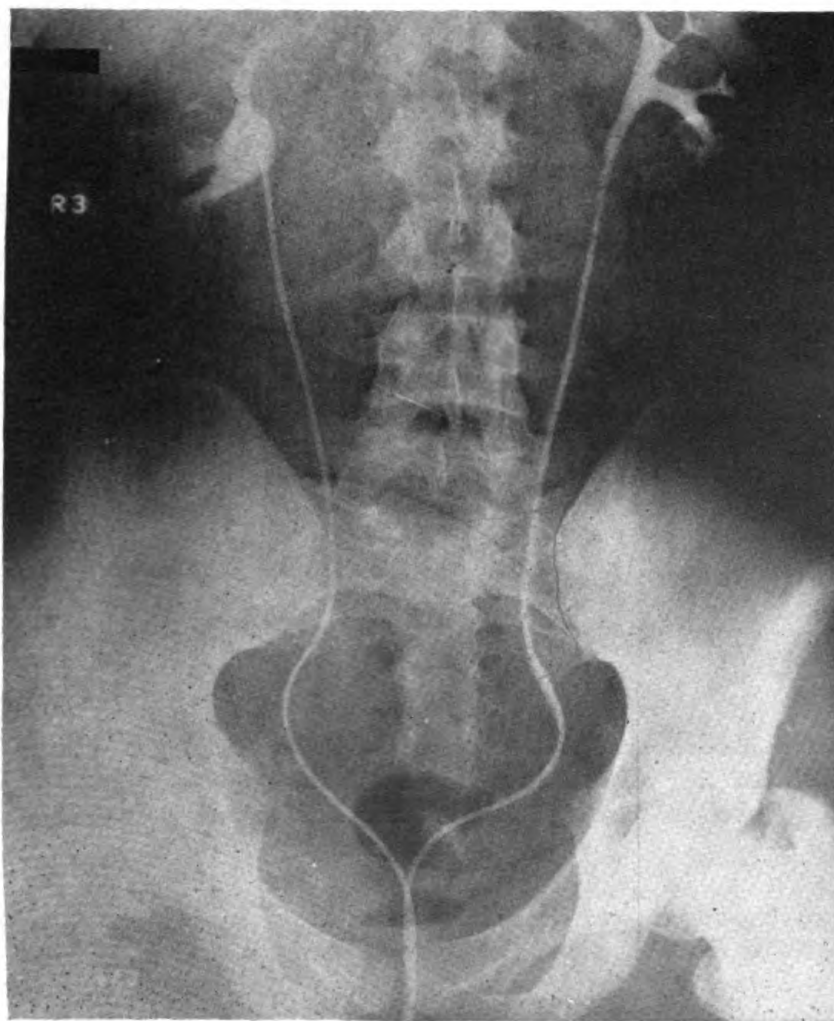
These are time-consuming operations requiring incision and manipulation of the renal capsule. Deming¹ in 1929, however, de-

¹DEMING, C. L.: Nephroptosis and its correction. *Tr. Am. A. Genito-Urin. Surgeons* 22: 131-147, 1929.

scribed a kidney fixation method whereby sutures are placed in the edge of the peritoneum and the perirenal fat and the quadratus lumborum muscle after the kidney has been placed high in its bed. In this manner a permanent hammock or "basket sling" for the kidney was formed which kept the organ fixed in position (fig. 1). The fibrous capsule of the kidney is not utilized in this operation. At this activity the results of this type of operation in several cases of nephroptosis and all cases which required nephropexy after mobilization of the kidney were excellent, as illustrated by the following cases.

CASE REPORTS

Case 1.—A 36-year-old enlisted man was admitted to this hospital complaining of having had a dull backache on the right side for the past year. About two weeks prior to admission, while carrying a 125-pound toolbox



2. Case 1. Pyelogram in the supine position. Opaque catheters in place. Good position of the kidneys.

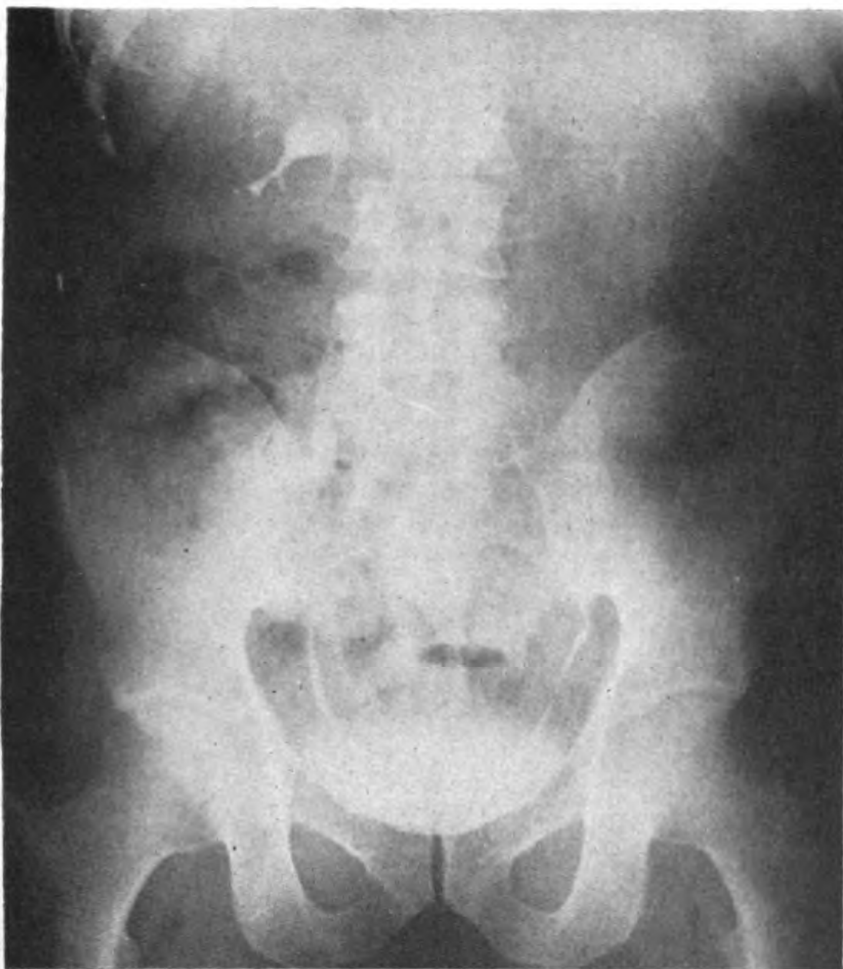
aboard a crash boat, he was thrown to the deck by a sudden lurching of the craft, the toolbox landing in his lap. The incident aggravated his backache, which was followed by a dysuria and urinary frequency. The back pain was relieved when he lay on his back and became severe after the patient was on his feet for a short time.

Cystoscopy done 2 days after admission revealed no pertinent findings in his bladder. A No. 6 French opaque catheter was passed to each renal pelvis without difficulty and a pyelogram was taken with the patient in the recumbent position (fig. 2). Both ureters were outlined by injecting opaque medium into the catheters as they were withdrawn. The patient was placed in the standing position and a pyelo-ureterogram was taken (fig. 3).



3. Case 1. Pyelo-ureterogram in the standing position showing ptosis of the right kidney and kinking of the ureter in 3 places (arrows).

The pyelogram showed both kidneys to be in good position, with slight pyelectasis of the right side. The pyelo-ureterogram showed a 5-cm. drop of the right kidney with evident kinking of that ureter. As there was a possibility that his back pain might have been caused by injury to his back muscles, he was referred to the orthopedic department where he was held under observation for a period of 2 weeks. A thorough workup resulted in a



4. Case 1. Postoperative pyelo-ureterogram in standing position showing good position of the right kidney and elimination of ureteral kinks.

negative orthopedic diagnosis. The patient was returned to the urologic service for nephropexy.

At operation the kidney was found to move freely with respiration. There was a kink of the upper ureter caused by inflammatory bands which when cut mobilized the upper ureter. The kidney was then placed high in its bed and a supporting hammock was formed by suturing the edge of the peritoneum and the perirenal fat to the quadratus lumborum muscle.

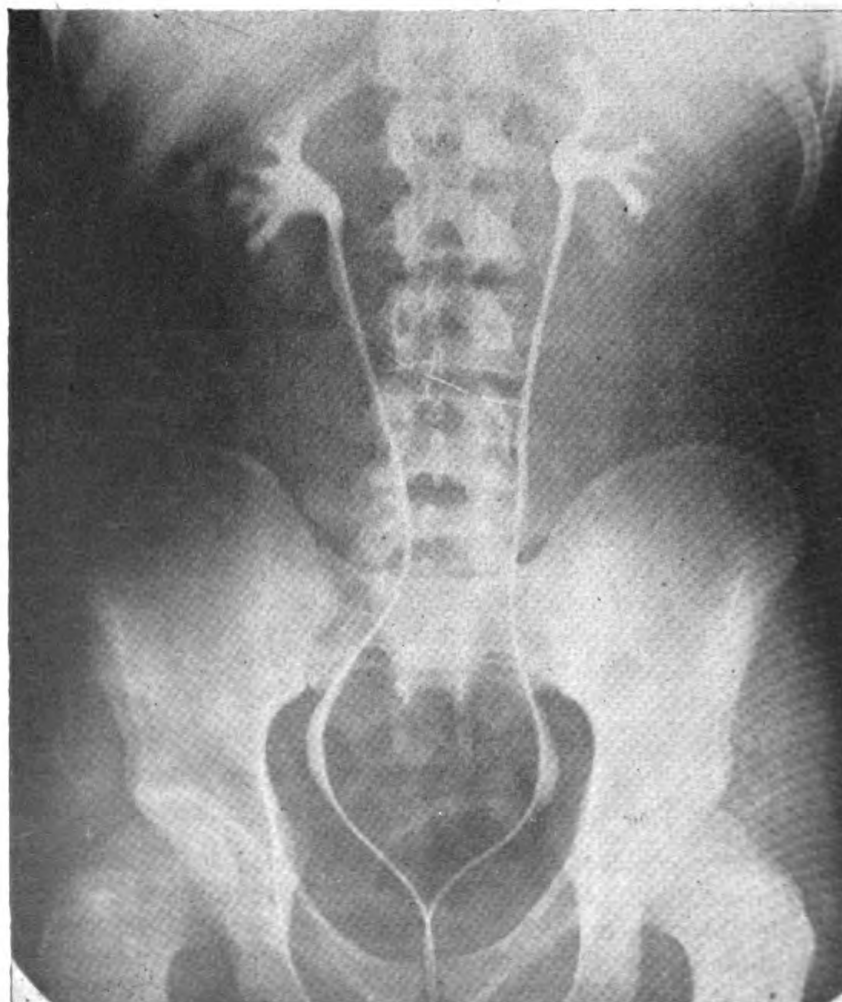
The patient made an uneventful recovery and after 6 weeks a postoperative retrograde pyelo-ureterogram in the upright position (fig. 4) showed the kidney to be in good position with a ureter devoid of kinks.

Case 2.—A 22-year-old enlisted man entered the hospital complaining of having had intermittent pain in his right flank for 2 years. He had been under urologic observation several times in the 2 years and on each occasion a right nephroptosis was found. He had several attacks of sharp knife-like pains in his right side which required opiates for relief. His last attack of pain was the night before his ship entered this port. There was no history of hematuria or passage of calculi.

The patient was slim, which made the right kidney readily palpated, and there were no other relevant findings on physical examination. On cystoscopy a No. 24 French Young cystoscope was easily passed into the bladder, the walls and contents of which were normal, and No. 6 French opaque ureteral catheters were passed with ease to each renal pelvis. About 6 cc. of 20-percent radiopaque material was injected into each renal pelvis and a pyelogram was taken with the catheters in place and the patient in the supine position (fig. 5). This was followed by a pyelo-ureterogram taken in the upright position after some dye was injected along the course of the ureters (fig. 6).

By comparing the two films, wide mobility of the right kidney was found. The pyelo-ureterogram showed sharp angulation of the ureter at the brim of the pelvis with ureteral dilatation above that point and kinking of the ureter at the ureteropelvic junction. The urogram of the left side was normal.

At operation 6 days later the right kidney was found to be very motile and there were some inflammatory bands about the upper ureter. These were divided and the ureter completely mobilized. There was no other evidence of obstruction.



5. Case 2. Pyelogram in the supine position showing good position of the kidneys. Catheters in place.

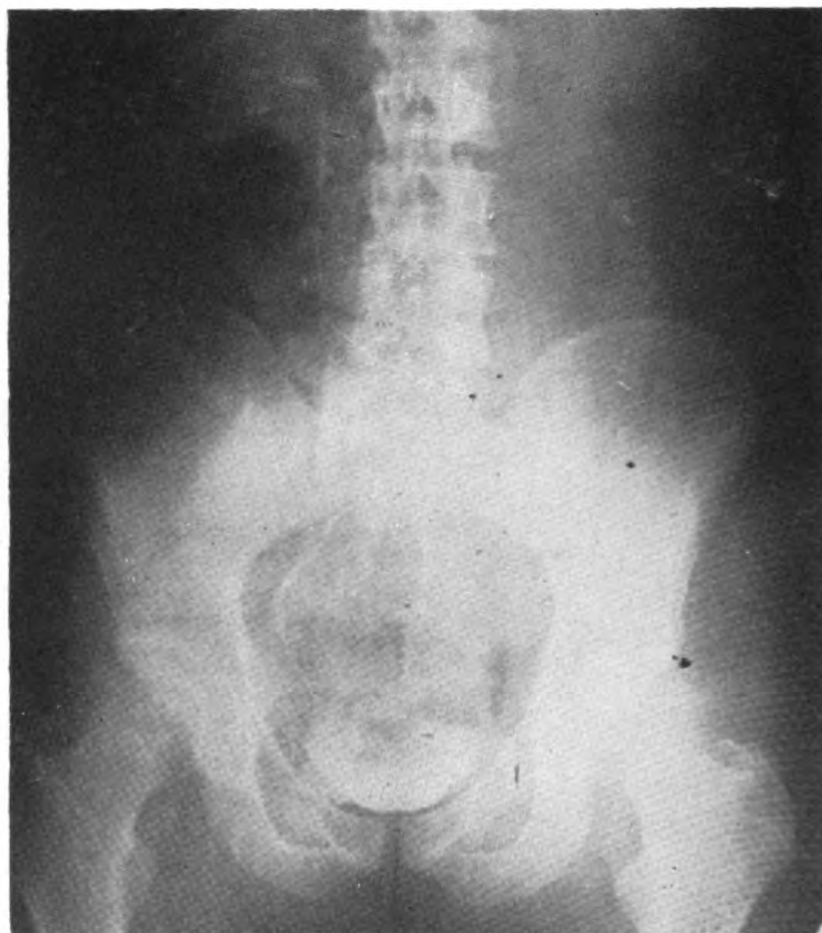


6. Case 2. Pyelo-ureterogram in the erect position showing ptosis of the right kidney and angulation of the ureter in two places (arrow.) (Transposed in printing).

The kidney was then placed high in its bed and made firm by the usual supporting hammock. Recovery was uneventful and an upright pyelo-ureterogram taken 27 days later showed a high fixation of the right kidney with straight ureteral outline (fig. 7). Drainage was excellent as shown by the paucity of dye remaining in the kidney pelvis and the large amount of dye which drained within a minute into the bladder.

Case 3.—A 37-year-old white man entered the hospital complaining of having had pain in his right loin for the past 14 years. He had been a bed-wetter for a number of years in his early youth. About 12 years ago he first had an attack of sharp lancinating pains in his right loin and several hours later he passed some bloody urine. Since then he has had attacks of sharp pain about 3 or 4 times a year. However a dull ache in the right side of his back was always present, especially after the patient was on his feet for a short time.

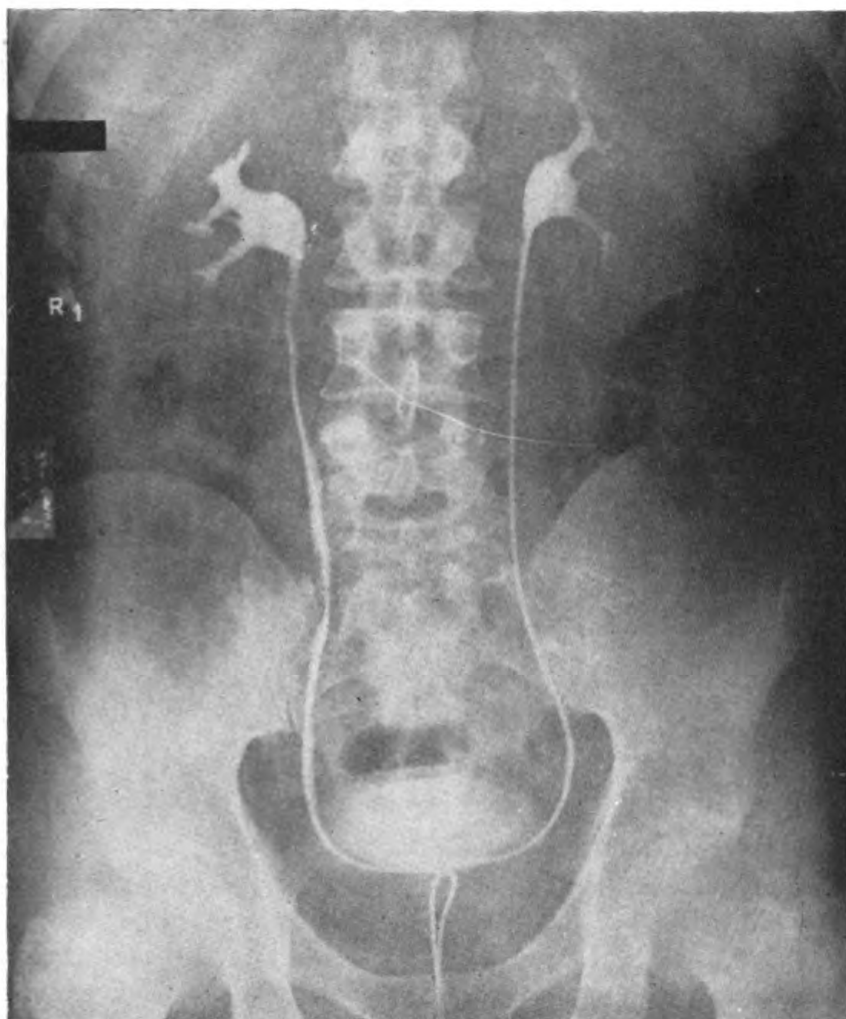
On cystoscopy a Young cystoscope was passed with ease into his bladder, which was seen free of all pathosis. A No. 6 French opaque ureteral catheter threaded each ureter to the renal pelvis without difficulty. Samples of urine



7. Case 2. Postoperative pyelo-ureterogram in the erect position showing high fixation of the right kidney and the elimination of ureteral angulations.

from each kidney were collected for culture and microscopic and urea determinations. Intravenous phenolsulfonphthalein was excreted from each side in 3.5 minutes and in good concentration. Six cubic centimeters of 20-percent radiopaque substance was injected into each renal pelvis and a pyelogram with the patient in the recumbent position was taken (fig. 8). While the catheters were being withdrawn, dye was injected along the course of the ureters and a pyelo-ureterogram done with the patient in the standing position. Ptosis of the right kidney was seen by comparing the two films. The ureterogram was not very clear but retention of dye in the right kidney pelvis was evident.

At operation several weeks later numerous fibrous bands were seen about the upper ureter and a large aberrant vessel was found crossing the ureteropelvic junction. The bands and vessel were divided and ligated, and the upper ureter and the kidney pelvis were freed of adhesions. The kidney was placed high in its bed and a supporting hammock made to hold it firmly in position. The patient made an uneventful recovery and 16 days postoperatively a pyelo-ureterogram was taken in the standing position. It showed the high position of the kidney and the rapid emptying of the kidney pelvis.



8. Case 3. Pyelogram in the supine position. Good position of the kidneys with slight pyelectasis on the right side.

SUMMARY

These three cases illustrate the uniformly good result obtained with the Deming type of nephropexy. Its utilization of the peritoneum and the perirenal fat for support of the kidney is less time consuming, does not traumatize the kidney, and is very effective. It avoids the complications which may follow nephropexies based upon mobilization through use of the renal capsule.



BACK SAVING HINTS



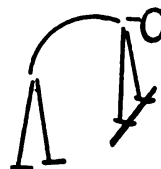
Sit properly. If still warm from work, slip newspaper or pillow behind back.



This posture rests nothing and strains everything.



The right way to lift, by pushing entire body upward with your legs.



The wrong way! All back muscles already on strain.



Arch your back in coughing or sneezing. Save wear and tear on taut muscles and ligaments.



Cough or clear your throat a dozen times in this posture and you'll get a backache to add to your other cold distress.

HELLER, E. P.: Back saving; an outline of home care and personal conduct. *Indust. Med.* 14: 508-510, June 1945.

METHOD FOR REMOVING URETERAL CALCULI BY CONTINUOUS INTERNAL TRACTION

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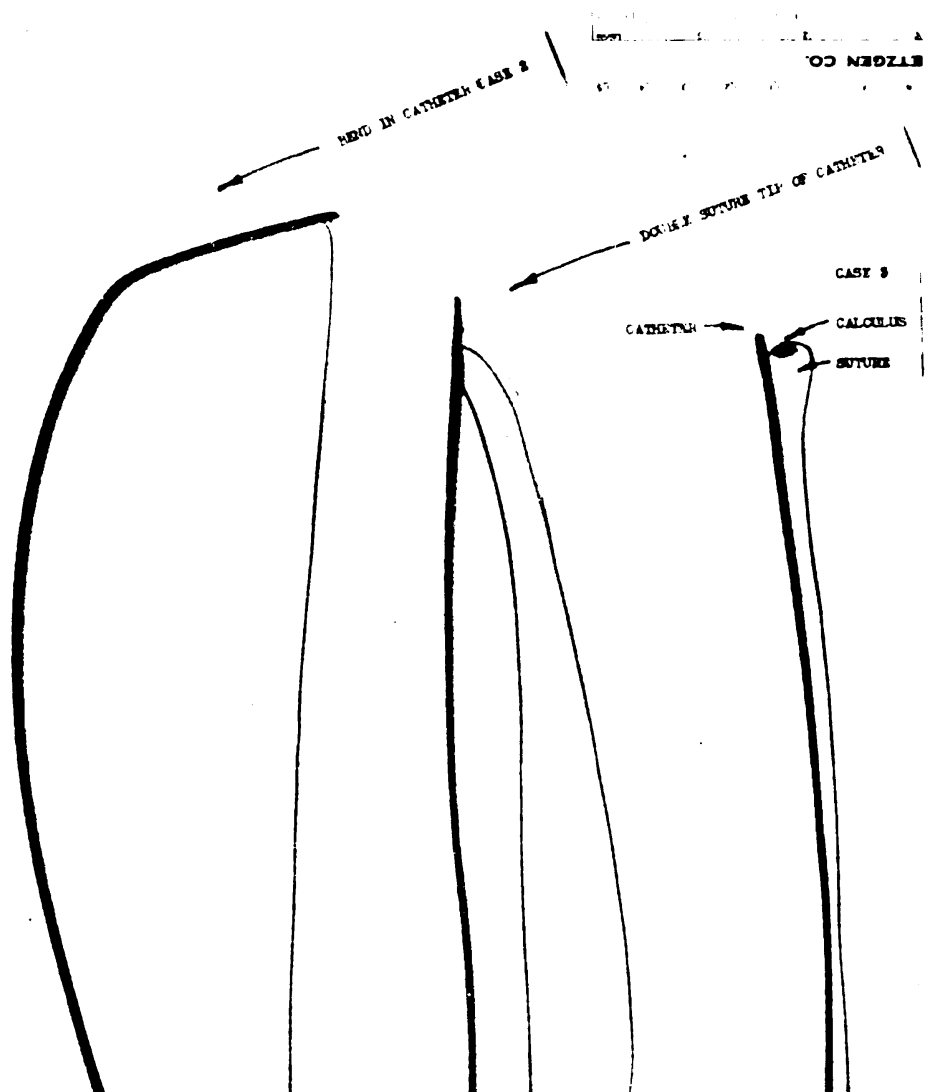
Removing calculi from the ureter by mechanical methods has never gained popularity nor has any method been accepted as a safe routine procedure. This has been brought about by the fact that the instrument is either too large for easy passage past the calculus in the ureter, or through fear of ureteral injury by forceful manipulation and traction. Finney,¹ however, states following experiments on large dogs that the ureters can withstand a pull up to 5 pounds without tearing. He describes a method for removing ureteral calculi by momentary 2-pound traction every hour for 24 hours with a looped catheter turned in the kidney pelvis, after which he delivers the calculus by 5-pound traction under general anesthesia. He was successful in 47 of 50 cases.

A procedure which has been found easy in application and potentially less damaging to the ureter than past methods consists in threading a No. 5 and a No. 6 French catheter with a No. 0 nylon suture. The catheters are readily threaded by waxing the suture and pushing it through one of the tip openings.

Sufficient length of the suture is allowed, approximately four times the length of the catheter, in order to extend the double suture over a pulley at the foot of the bed. A 1- to 2-pound weight is secured to the ends for continuous traction on the calculus in the ureter. When two sutures alongside the catheter are desirable they are threaded through the two tip openings of the catheter. This method was found more difficult in trying to pass the stone in the ureter, but it is useful when the ureter is large and when the stone is small or difficult to engage (fig. 1).

The calculus is lassoed by the suture alongside the catheter by twisting the catheter as it passes the calculus or by pulling one or the other end of the suture until the stone is engaged. Engagement of the calculus is readily felt on traction. When the calculus

¹ FINNEY, R. P.: Principle of traction in treatment of uretero-lithiasis. J.A.M.A. 117: 2129-2131, December 20, 1941.



1. The catheter-suture set-up. The bend in the No. 6 French catheter (left) was caused by the calculus engaged in case 2. The calculus pictured with the No. 5 French catheter (right) was delivered in Case 3.

is engaged, the cystoscope is removed, and the patient is transferred to his bed. With his feet braced on the foot of the bed, a 1-pound weight is added gently to the end of the sutures which hang below the foot of the bed over a pulley (fig. 2). A flat x-ray plate is taken in order to show the calculus engaged (fig. 3).

Morphine $\frac{1}{4}$ grain with atropine $\frac{1}{150}$ grain, or pantopon $\frac{1}{10}$ grain is given at the time of the cystoscopic manipulation and this usually suffices to keep the patient comfortable during the traction. More is given if required; however one dose every 4 hours was found adequate. Depropanex, from 3 to 5 cc., also is given intramuscularly to assist in the relief of ureteral spasm.

If the calculus is not delivered within 3 hours with 1-pound traction, another weight of from $\frac{1}{2}$ to 1 pound is added, depending upon the patient's reaction to the added pull. A pull of 2 pounds does not seem to disturb the patient.

No injury to the ureter was observed on cystoscopic examination after the delivery of the calculus, and less reaction was found in the patients than that which has been seen when a calculus was passed spontaneously. This may be attributed to the shorter time taken to deliver the calculus; moreover the danger of renal injury is greatly lessened by removing the obstructing calculus in the ureter, and the internal method is safer than a ureterolithotomy as well as of much less risk to the patient than an operation. It also avoids the hazard of spinal or general anesthesia, postoperative care and prolonged hospitalization.

Delivery of calculi by this method is not recommended for every case of calculus in the ureter until a fair trial by normal delivery or a reasonable trial by catheter manipulation has been done, but it is to be recommended when open operation is considered necessary.



2. Case 3. One-pound traction set-up with the calculus engaged. The sutures are separated for clearer demonstration.

CASE REPORTS

Case 1.—A calculus was discovered in the left kidney pelvis 96 days before it was finally delivered. Seventy days after the diagnosis of calculus was made it was found in the ureter. The patient received 6 cystoscopic treatments which consisted of leaving catheters in the ureter until they came down of their own accord, which was usually less than 48 hours. No results were obtained by this method during the course of 26 days. The calculus, however, was delivered in 2 hours and 50 minutes with a 1-pound weight by the continuous internal traction method. Two days after delivery of the calculus, a perinephritis developed which cleared up under 5 intramuscular doses of 20,000 units of penicillin each given every 3 hours.

Case 2.—A calculus discovered in the left kidney 205 days before delivery, was found in the left ureter 189 days after the diagnosis was made. The



3. Case 3. The catheter with the suture lassoed about the calculus in the right lower ureter may be seen to the left of and behind the cystoscope.

patient received 4 cystoscopic treatments with no results from these manipulations during 16 days. A pustular prostate gland and a local ureteritis near the calculus developed which cleared up with local treatment, after which the calculus was delivered under 1-pound continuous traction for 9 hours. This calculus measuring 1 by 0.5 cm. in diameter was the largest of the 6 delivered and was principally composed of calcium oxalate.

Case 3.—A calculus was discovered in the lower right ureter 49 days before delivery. The patient had received 3 cystoscopic treatments with no results from these manipulations during 15 days. The calculus, however, was delivered under 1-pound continuous traction in 2 hours and 25 minutes.

Case 4.—A calculus was discovered in the lower right ureter 14 days before delivery. The patient received 2 cystoscopic manipulations during 10 days. The calculus, on the other hand, was delivered under 1-pound continuous internal traction in 30 minutes.

Case 5.—A calculus was diagnosed in a patient suffering from a renal colic 33 days before its delivery. The patient was cystoscoped and the stone manipulated into the left lower ureter 12 days before it was delivered by 1-pound continuous internal traction in 45 minutes.

Case 6.—A calculus was found in the right lower ureter 8 days before delivery. The patient's past history revealed a right renal colic on 3 occasions prior to the calculus diagnosis. He was cystoscoped on admission to the hospital and the calculus was delivered under 1-pound continuous internal traction for 3½ hours followed by 1½-pound continuous internal traction for another hour and 25 minutes.

All 6 of these patients were cystoscoped a day after the calculus was passed from the bladder and they were all seen a month or more later. No injury was discovered to the ureter and the patients were symptom free. In all cases less edema was seen about the ureteral orifice following delivery than that which has been observed on examination following the normal passage of a calculus.

SUMMARY

A method is described which is available in any cystoscopic room. Calculi are easily delivered from the lower ureter by continuous internal traction employing 1, 1½, or 2 pounds applied to the calculus in the ureter by a catheter-nylon-thread. Six cases in which this method was used are reported where manipulation with catheters did not bring about results and where open operation such as a ureterolithotomy was avoided.

DENTAL PROGRAM OF AN AMPHIBIOUS FORCE

REPORT OF A SURVEY

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Lieutenant (DC) U.S.N.R.

and

SEYMOUR L. NASH

Lieutenant (DC) U.S.N.R.

With amphibious warfare there has come into being a great number of highly specialized small Naval vessels. The LST, LCI, LCT, AM, YMS, PC, ATF and other similar craft have posed many new problems for the Navy, not the least of which is the supply of adequate dental care.

In this survey, ships of all these types were boarded and their personnel examined. An endeavor was made to be as complete as possible; however some ships in the amphibious force were not reached, and on many of the ships boarded a few of the crew were missed. Nevertheless a total of 93 ships were visited and 6,131 men were examined.

Through pharmacist's mates, who in most cases are the only medical department representatives on small craft, and through medical officers assigned to divisions and flotillas, a demand for dental treatment of personnel assigned to small craft was being consistently relayed to the force medical officer. The demand, however, was not being met. In order to gage properly the amount of treatment necessary a thorough survey was instigated. It was also thought that as ships were returning to the States an excellent opportunity was afforded to inform those bases which the vessels reached regarding the amount of dental treatment necessary for the personnel aboard.

The survey was assigned to one dental officer who was aided by each ship's pharmacist's mate or yeoman. The work was done aboard the vessel, in the sickbay when available, or in any other suitable space. A power lamp for illumination and an ordinary chair, mirror, and sharp explorers were the only equipment used. In this manner 6,131 men were examined throughout 6 weeks, the lengthy period being caused by ship sailings, a necessary shifting of the officer from place to place, and the fact that the survey was worked into the normal activity of ships without any priority.

The men examined were classified according to the following standards and placed into five classes.

Class 1.—These patients required immediate treatment, either in order to save important teeth or to prevent pain and infection in the near future. This class included acute infections such as Vincent's angina. One carious lesion, thought to involve or threaten to involve the pulp, was considered sufficient to place the patient in this class.

Class 2.—These patients had cavities of a size necessitating treatment within a few months. Patients having more than five cavities regardless of size, and yet who did not come under class 1, were placed in this group, as were those who had any proximal cavity which was large enough to involve the marginal ridge. This group included chronic infections of the mouth.

Class 3.—The patients comprising this group had less than five cavities, none of which appeared to be in need of early treatment; unless it was clearly a large cavity, instances of proximal caries in which the marginal ridge was not involved were placed in this category.

Class 4.—This group consisted of patients for whom there was no apparent need for dental treatment other than a routine prophylaxis.

Class 5.—All patients needing prosthetic treatment were given this classification; it consisted of patients not having sufficient teeth to meet U. S. Navy standards.

The results of this survey are shown graphically in the table below, from which it is clear that the reports of a great need for dental treatment were verified. Moreover with one-third of the personnel in need of immediate treatment the situation was urgent.

Dental survey of 6,131 men aboard small craft

Class	Number	Percentage of total
1.....	821	13.38
2.....	1,233	20.12
3.....	2,065	33.68
4.....	1,688	27.53
5.....	324	5.28

Methods of obtaining treatment previous to the survey were then studied and found to exist as follows:

1. *Navy.*—The larger bases in the area had dental officers assigned and working in dispensaries and hospitals. Ships on arriving at the base would send men there for treatment.

2. *Army.*—In areas where there were no Navy dental officers men were sent to Army units for emergency treatment and for urgent work. It can be said that the cooperation was splendid and work was done on as many men as possible. However the amount of work accomplished in this way was negligible. It was realized that such treatment was totally inadequate. The survey showed a tremendous need, and from the experience of the 18 months to two years the force had been in the area, it was decided that exist-

ing facilities were inadequate even for the maintenance of dental health and would be unable to carry the extra burden indicated by the survey. Therefore the establishment of some sort of supplemental activity was proposed.

Work was begun on a mobile dental unit. This type of dental facility was decided upon because it was thought to fill best the peculiar requirements of amphibious small craft. It would be able to move with the force, be set up immediately, and be operating upon arrival in port. It would function at the pier and thus save man-hours spent in travelling to and from base facilities, which are often at great distances from dock areas. It would function with a unit and could remain with the unit from the beginning to the end of its commitment. In actual landing operations it would serve admirably as a battle dressing station.

This mobile dental unit was set up at an advance amphibious training base. A captured trailer was used to house the unit, and actual construction was done by a Seabee maintenance unit. An S. S. White master unit and a Ritter chair were installed. These, plus a regular office cabinet and a GE wall-type x-ray, constituted the major pieces of equipment. In addition, closets, desk, a sink and other storage spaces, were constructed. A portable x-ray developing unit was installed. With the plumbing and wiring accomplished the unit was ready for operation. The trailer could hook up to either base or ship's water and power facilities, but it also has its own generator, a small trailer-type model. Plans are being made to install a water tank, making the unit entirely self-sufficient except for locomotion. It is a simple matter, however, to place it upon landing craft. Its personnel includes two dental officers and two dental technicians, who operate two full shifts, from 0800 to 1600 and from 1600 to 2400.

The unit has been in operation 7 weeks, working only on class-1 and class-2 patients. Emergencies are of course handled as well. Close cooperation is maintained with the pharmacist's mates aboard all vessels attached to the force. Each vessel is assigned a certain number of appointments, depending on the number of ships in port and on the class-1 cases aboard.

Work has been limited to compound cavities and large simple ones in an endeavor to save as many teeth as possible. Following this policy, no routine prophylaxes or the filling of simple pits have been undertaken. Men are notified upon completion of essential treatment that they still need dental care and are told to report to a dental officer within 3 or 4 months. This is considered mere "stop-gap" dentistry. However the emergency warrants ex-

traordinary measures and it is hoped that when the emergency stage has passed, more normal procedures and routine dental care for the force can be established. It has been found that a large number of extractions have been necessary. Many of the teeth doubtlessly could have been saved had dental treatment been instituted months earlier. Loss of teeth has led to prosthetic problems in many instances. Many men do not meet Navy requirements, yet it is difficult for them to obtain prosthetic care because of the highly mobile state of their ships.

From the experience of the past weeks it has been found that the survey classifications were very accurate. Hence it is thought that valid conclusions may be drawn from the facts brought out by the large sample examined and the work done. The majority of the men examined have been in the area more than 12 months, some as long as 24 months, which further emphasizes the necessity for constant care if good dental health is to be maintained. It is not sufficient merely to bring men up to good dental standards at one time and then allow them merely to take care of themselves. It shows also that existent dental facilities attached to shore bases in this area have not been able to keep the forces afloat supplied with adequate dental care.

There are several reasons for this inability to carry out in practice what has been established in theory:

1. There are insufficient dental personnel attached to these bases. The number is usually based on the number of base personnel.

2. Ships arrive and leave on short notice and are available only for short periods of time. This makes for a tremendous rush of work at one time, which the base dental officers are unable to handle.

3. Notwithstanding the fact that bases are primarily for the servicing of forces afloat, it has been shown repeatedly that there is pressure on the dental officer to care for the men with whom he is serving. It is difficult to withstand such pressure.

Another fact was brought to light which is worthy of mention. A number of men were encountered who had had no dental work after the dental induction examination, i. e., had received no dental treatment while in recruit training; or if some dentistry was done, not even the necessary work as shown by the form H-4 was completed. These men usually had conditions which had been aggravated by neglect over a year or more. A complete fulfillment of the theory of a 4.0 dental rating upon completion of boot training is an essential step in a successful dental health program.

COMMENT

Continual dental care is the only way to maintain good dental health in any large group of men. For personnel of amphibious craft with no dental officer assigned it is difficult to obtain treatment under existing conditions in this area.

The only remedy for this situation would be the assignment of dental officers to some part of the amphibious force organization, for example, the staff of a group of LSTs or a flotilla of LCIs. A table of organization should be worked out whereby the dentist would be assigned a certain number of ships and men, and be responsible for these men alone.

From the experience of this dental unit it is concluded that simple small mobile units can be constructed to carry equipment and supplies and always be in a state of readiness for operation. It requires little effort or time to set up, is economical in every phase of the dental problem, and permits better dental care for groups of small craft.



CHEST PAIN OF ESOPHAGEAL ORIGIN

The location, quality and intensity of the pain due to esophageal disorders may be indistinguishable from that due to disease of the coronary arteries. In both conditions the pain may be precipitated by emotional disturbances and by the ingestion of large quantities of food. In the differentiation of angina pectoris from pain brought about by disorders of the esophagus, one of the most useful methods of diagnosis is induction of the pain when the patient is under observation. This can nearly always be done by muscular exertion in patients with angina pectoris. Esophageal pain can be precipitated in some patients by the ingestion of highly seasoned food or of alcoholic liquors, and especially if these irritants are swallowed when the patient is recumbent. In other patients esophageal discomfort may be induced by distending the stomach or the esophagus with air or with water. Since these procedures may cause discomfort in healthy persons they are only significant when they reproduce exactly the spontaneous discomfort of which the patient complains.—HARRISON, T. R.: Clinical aspects of pain in chest; pain arising from the esophagus. *Am. J. M. Sc.* 209: 765-771, June 1945.

SURGICAL PHASE OF AMPHIBIOUS WARFARE

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The purpose of this paper is to discuss the work done by the medical personnel on an attack transport during a recent amphibious operation. The function of an attack transport is to transport troops and cargo to an amphibious operation, discharge the troops into small landing craft, and stand by and await the resultant casualties.

All casualties taken aboard this ship had received first-aid treatment from medical officers or hospital corpsmen on the beach. This treatment consisted of control of hemorrhage, application of sulfanilamide powder to wounds, application of sterile dressings, and administration of 0.5 grain of morphine sulfate when indicated for the relief of pain. The patients were then transferred to one of two LSTs stationed off the beach, where shock therapy was given and an evaluation of the patient's condition was made. The patients were then apportioned to the ships where definitive care could be administered.

This ship, an APA, carries a complement of 5 medical officers, one of whom worked on one of the LSTs, 1 dental officer, 1 chief pharmacist's mate, and 37 hospital corpsmen.

On the main deck amidships, and adjoining each other, are the first-aid room used for daily sick call and now converted into a plaster room, the sickbay with a 13-bed capacity, the operating room, and the officers' wardroom containing 4 long tables, each table to accommodate 1 stretcher patient. There was adequate additional deck space in the wardroom for 8 stretchers, placed on specially built iron stands which bring the stretchers up to table height. This wardroom is used as a receiving room as well as a minor surgery room for immediate cleansing and debridement of all wounds.

A casualty flag was flown by transports to indicate that they were prepared to receive casualties; and this flag was hauled down when the patient load was sufficient to keep the medical personnel busy for several hours. Thus the distribution of casualties to ships was more or less equalized.

During this operation 178 casualties were received aboard. Of the total number received, 118 were wounded and the remaining 60 suffered either concussion, shock, or combat fatigue. On D plus 8, eighty-one patients were admitted in 2½ hours and were hoisted aboard from both sides of the ship, the stretcher patients either by means of litter hoists or by hoisting the small boats to deck level and then lifting the stretchers out and carrying them directly through a specially constructed watertight door in the bulkhead to the wardroom.

In the wardroom the patient's name and other information necessary for the clinical chart were obtained by a corpsman while clothing was cut off, bandages were being removed, injuries inspected, tetanus-toxoid booster injections given, and shock therapy started if necessary. The patients were then prepared for debridement or whatever surgery was indicated. In all, 34 pints of Type-0 whole blood, 80 units of plasma, 36 liters of 5-percent dextrose in normal saline, and 4 vials of serum albumin, each vial containing 100 cc., were used.

The majority of the debridements were done in the wardroom. Using sodium pentothal anesthesia intravenously, the wound was shaved over a wide margin, washed with soap and water, and prepared with tincture of merthiolate. The skin edges and the deeper tissues were trimmed and all pieces of clothing, bone fragments and easily accessible foreign bodies were removed. The wounds were thoroughly irrigated with normal saline solution, sulfanilamide crystals were placed both deeply and superficially, and the wounds were packed loosely with vaseline gauze. Large comfortable dressings were applied after it was certain that hemorrhage had been controlled.

Only one wound was sutured during this operation, a small incised wound of the face; this was followed by primary healing. This patient and one other with a small abrasion on the face were the only patients returned directly to duty from this ship.

The ship's dental officer and one of the medical officers with special training in anesthesia acted as anesthetists. Local anesthesia was not used because of lack of time, and in many instances the multiplicity of injuries precluded its use.

Spinal anesthesia, the anesthetic of choice in abdominal surgery, was not used in the seven abdominal cases because of the generally poor condition of these patients. One patient had a systolic blood pressure of 90 following a traumatic amputation of the left arm on the beach. Later an exploratory laparotomy was done because of a gunshot wound of the abdomen.

Pentothal sodium was used intravenously in four patients with

abdominal injuries and ether in the remaining three. Pentothal sodium proved a poor choice, however, because of extreme difficulty in closing the abdomen, even when this anesthetic was supplemented by procaine hydrochloride injected locally into the peritoneum and abdominal wall.

There was one simple fracture of the tibia and fibula as a result of a man falling on another in a small boat. There were 32 compound fractures in 22 patients. Seventy-nine roentgenographs were taken; these included two views in almost every instance. There were 12 of the chest, 3 of the skull, 9 of the spine, 4 of the pelvis, 9 of the arms, 12 of the legs, 9 of the hands, 10 of the feet, 6 of the abdomen, 4 of the shoulders, and 1 of the jaws.

The wounds were treated as previously outlined and extremities were immobilized in plaster-of-paris casts over adequate padding. A reasonable attempt was made to reduce fractures and great care was taken to obtain normal alinement of the extremities.

There was sufficient nerve injury in one upper and one lower extremity to produce wrist drop and foot drop and care was taken to see that the hand and foot received adequate support. Eight patients who had abdominal injuries were operated upon; there were two deaths. The time between injury and operation ranged from 2 to 10 hours. Both of the operative deaths were the result of extensive shell fragment injuries. One of these patients required resection of 18 inches of badly lacerated small bowel and an end-to-end anastomosis was done. The other was brought aboard with several loops of jejunum extruded onto the abdominal wall as a result of a shell fragment injury. Three inches of small bowel had been blown out at the ligament of Treitz, and an end-to-end anastomosis was done. This patient also had five perforations in the jejunum, one perforation in the cecum, and two lacerations, each 2 inches long, in the transverse colon.

Of the 6 patients who survived, one had two perforations in the jejunum requiring purse-string suture closures and also had a traumatic amputation of the left arm at the elbow; one patient had one perforation of the transverse colon which was exteriorized; and one had a shell fragment wound of the right side of the chest anteriorly in the right midclavicular line at the level of the hilus of the right lung.

The shell fragment had travelled downward through the diaphragm, leaving a rent 2 inches long in the diaphragm and producing a deep laceration in the dome of the liver, which in turn caused severe pulmonary and liver hemorrhage. The rent in the diaphragm was sutured and the liver packed through a right subcostal (Kocher) incision. The pulmonary hemorrhage ceased

spontaneously after 5 days, during which time 10 pints of blood were aspirated from the chest at the rate of 2 pints per day and an equal amount was administered intravenously daily.

Another patient required packing of the liver to control extensive hemorrhage. Yet another had a jagged 3-cm. penetrating wound in the right midclavicular line at the level of the ninth rib, and no wound of exit. An x-ray film of the lumbar region revealed a rifle projectile lying nose downward at the level of the first lumbar vertebra, 2 cm. to the right of the midline. The urine showed considerable gross blood. The abdomen was explored through a Kocher incision and no blood or evidence of injury was found in the peritoneal cavity. No perirenal mass was evident on palpation. The bullet was not palpated, and the abdomen was closed in layers without drainage.

The remaining patient in this group had a through-and-through bullet wound of the right lumbar muscle group at the level of the first lumbar vertebra. After 24-hours' hospitalization there developed what appeared to be an acute condition of the abdomen with almost boardlike rigidity of the right rectus muscle and over the right lower quadrant. He also gave a history of two severe previous attacks of acute appendicitis. The abdomen was explored through a right rectus incision. No intraperitoneal damage or pathosis was found but the appendix was removed because of the previous history of acute appendicitis.

There was one saber wound severing the ulnar nerve at the distal third of the forearm. This was a clean wound and a nerve repair was immediately done.

There was one sucking wound of the chest, which was controlled by packing. This patient also had a spinal cord injury.

There were four eye cases, three requiring the services of an ophthalmologist, and two of them in need of enucleation. These three patients were transferred to an ophthalmologist in the transport group. Also one enucleation was done aboard this ship; the patient's eyeball was destroyed and additional injuries precluded his transfer.

There were three deaths in this series of 178 patients, two occurring postoperatively and one in a patient who had no evidence of external injury except for a slight ankle wound. The amount of morphine administered to this patient before he came to this ship was not accurately determined, but it serves to emphasize the importance of an accurate record of what therapy has been previously instituted on the beach. The patient was in moderate

shock when he came aboard, complained of pain in his injured ankle, and morphine, grain $\frac{1}{4}$, was administered for relief. There was no further complaint of pain and in about 2 hours the patient lapsed into unconsciousness and expired despite oxygen, artificial respiration, stimulants and all attempts to resuscitate him. The possibility of the initial dose or doses of morphine not being absorbed as a result of the state of shock cannot be overlooked.

Every wounded patient was given 2 gm. of sulfadiazine by mouth on admission and 1 gm. four times per day for 5 days.

All patients who had compound fractures or abdominal wounds were given 20,000 units of penicillin on admission and 20,000 units every 4 hours. This was continued until it was feared the supply of penicillin might become exhausted before we arrived at the base hospital, and administration of the drug was limited during the last 3 days to the more serious cases.

Forty soft-tissue wounds, exclusive of the compound fracture wounds, were debrided aboard ship. These debridements were all thoroughly done but the time allotted to each depended on the urgency of other work at hand. All wounded patients were given a 0.5-cc. injection of tetanus-toxoid booster on admission unless they had received it on the beach. There were no cases of tetanus in this group.

Gas bacillus antitoxin was given in four instances when it was believed indicated. No case of gas infection developed.

Dressings were changed on an average of twice aboard ship, depending upon the indications. Wounds with good debridement and properly applied dressings were only changed once.

On the day prior to departure from the combat area, a complete survey of the patient load was made by the senior medical officer and the casualties were divided into three groups, namely, white, blue, and red (tag) casualties.

White casualties were designated as those ready to resume duty within 2 weeks.

Blue casualties were designated as those ready to resume duty within 2 months; this group was further divided into ambulatory and stretcher cases.

Red casualties were designated as those who would be incapacitated longer than 2 months, and were likewise divided into ambulatory and stretcher cases.

All white tag casualties were transferred to a ship that was going to remain in the combat area, while the blue and red tag casualties (a total of 80 patients, 36 on stretchers, and 44 ambulatory) were evacuated to a base hospital.

SUMMARY

One hundred seventy-eight casualties were treated aboard this attack transport during an amphibious operation. There were three deaths in this series, two occurring postoperatively following extensive bowel resections.

The importance of an accurate record of the amount of morphine and other medication administered on the beach cannot be overemphasized.

There were 32 compound fractures in this series. One nerve repair of a severed ulnar nerve was done.



NERVE BLOCK FOR THORACIC BATTLE INJURIES

Obliteration of pain by intercostal and paravertebral nerve block is an important step in the treatment of thoracic trauma. Recovery from shock is speeded, obstructing bronchopulmonary secretions are raised more efficiently, and the patient may be transported with greater safety and comfort. Absence of pain following thoracic operations will simplify postoperative care. Since nerve block has been employed, thoracic adhesive strapping for the control of pain has been discarded.—SAMSON, P. C., and FITZPATRICK, L. J.: Intercostal nerve block. California and West. Med. 62: 254-256, May 1945.



PARA-AMINOHIPPURIC ACID PROLONGS PENICILLIN ACTION

When the plasma p-aminohippuric acid concentration was maintained at or above 10 mg./100 ml., a 3- to 6-fold elevation in penicillin plasma concentration was obtained except in two instances. When the p-aminohippuric acid plasma levels were allowed to fall below 10 mg./100 ml. there was no effect of that compound on the plasma concentration of penicillin. The p-aminohippuric acid was nontoxic in the dosage given even when administered over a period of 8 days.—LOEWE, L.; ROSENBLATT, P.; ALTURE-WERBER, E.; and KOZAK, M.: Prolonging action of penicillin by para-aminohippuric acid. Proc. Soc. Exper. Biol. & Med. 58: 298-300, April 1945.

THE CARE OF THORACIC WOUNDS AS ADAPTED TO THE PACIFIC THEATER

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The care of a serious war wound of the chest from the viewpoint of Naval casualties falls naturally into three stages: (1) Immediate or emergency care at the field hospital or forward dressing station; (2) definitive emergency care at the field hospital, or hospital ship anchored nearby; (3) later definitive care at a base hospital in the Pacific or in the continental United States.

Little can be done at the forward dressing station except to give morphine, apply a dressing (an occlusive one if the wound is of a sucking type), administer plasma, and maintain a clear airway. If there is a large bronchial fistula, as in an extensive laceration of the lung, the sucking wound is closed with plain or vaseline gauze and the escape of air is provided for by an intercostal catheter or by a catheter in the wound itself, with a flutter valve which is made by tying to the end of the catheter a perforated condom or a slit rubber glove finger. A patient who is bleeding from the mouth must be transported in a three-quarter-prone position rather than flat on his back. Some patients with chest wounds do better in a semi-Fowler's position, the chest and head supported by a folded blanket. Some will be more comfortable lying on the side of the injury with head and chest elevated on a blanket.

On arrival at the field hospital, or at the hospital ship if evacuation is immediately possible, the patient's condition will again be subject to appraisal. Intranasal oxygen is life-saving in the dyspneic patient and plasma may again be administered. Administration of intravenous fluid must be circumspect, however, in a patient whose respiration is limited to one side of the chest, or in whom pulmonary râles are heard, or in whom there is a high venous pressure which is apparent by the distention of neck veins when the patient is in the sitting position.

A history of the injury will yield certain pertinent data which will assist in an appraisal of the patient's condition and in his disposal: (1) The type of missile will give a clue to the extent of the possible damage to tissues, a fragment of shell or bomb being more dangerous than a rifle or machine-gun bullet, although the velocity of the latter may render it more destructive, particularly when ribs are struck; (2) consideration of the patient's position when struck will aid in determining the passage line of the missile and the possible organ or organs damaged; (3) the patient's state of consciousness immediately after injury may give a clue regarding the extent and seriousness of the bleeding. Hemoptysis suggests a lacerated or contused lung. Dyspnea is almost an invariable accompaniment of thoracic wounds, as also is thoracic pain. Cough suggests an intrapulmonary lesion involving the bronchi, and is most frequently caused by blood in the bronchial tree, but may also result from bronchial tree distortion which is produced by a massive effusion or total pneumothorax.

A quick but careful physical examination will also aid in appraising the patient's condition and in determining his immediate disposal. How much the chest lesion contributes to the patient's disability must be determined. In the combined abdominothoracic wound and in injuries to the thorax and extremity the chest condition is usually stabilized first, such as closing a sucking wound, or aspirating air or blood, before proceeding with exploration of the abdominal cavity or with the application of plaster for a fracture.

The stability of the thoracic cage and the possibility of rib fractures must be observed. Adhesive strapping of the chest will assist in restoring stabilization but when three or more ribs are fractured and paradoxical respiration is severe, a towel clip applied to one of the fractured ribs will permit elevation and stabilization of the thoracic wall by extension or pull on the clamp. Fixation of the clamp by plaster, or by overhead extension, or even manually, may be life saving. This group usually comprises those patients whose wounds are caused by missiles penetrating the thorax tangentially.

Limitation of motion on one side usually indicates compression of the lung on that side either by blood or by air or from injury to the rib cage. A shift of the mediastinum as disclosed by a shift in the apex beat of the heart suggests compression either from air or from blood. An extreme shift accompanied by distressing dyspnea demands immediate aspiration. This may be readily performed by introducing the aspirating needle in the second or third interspace in the nipple line following the closed paracentesis technic.

This approach affords several advantages. The position of the distressed patient need not be altered for the procedure. Air if present, with or without underlying fluid, will be removed first. If the amount of air capable of being withdrawn is inexhaustible, a bronchial opening is present and continuous drainage is in order. A long rubber tube from a plasma set is attached to the needle and led to an underwater seal. If the escape of air by needle is insufficient to control the pleural air and the dyspnea, a small rubber catheter may be introduced into the second or third intercostal space and connected with an underwater seal.

If bright blood is obtained on aspiration, an amount sufficient to control dyspnea is removed, usually about 300 to 400 cc., without air replacement. The removal of large volumes of blood is avoided in order not to reopen a bleeding vessel. Should pain intervene, enough air is introduced to stop it, this requiring usually from 75 to 100 cubic centimeters. If dyspnea persists, intranasal oxygen, morphine, and complete rest are provided; if these are unsuccessful, thoracotomy for the control of bleeding is indicated but only if positive-pressure anesthesia is available. Without it, the hazards of operation are greater than expectant treatment, relying upon pressure of the hemothorax to stop the bleeding. Repeated aspirations of limited volumes of blood, accompanied by repeated transfusions, may be more advantageous than the hazard of open thoracotomy. If the bleeding is from intercostal vessels, circumferential ligatures around a rib applied under local anesthesia may be effective; or the 2 ribs with the bleeding vessel between them may be sufficiently compressed by ligatures applied around them. The ligatures must be applied both anterior and posterior to the bleeding point if they are to be effective. Bleeding from the large hilar, mediastinal, or subclavian vessels may be rapidly fatal.

Inspection of the wound will yield information regarding the need of operation for closure of a sucking wound. If so the damaged tissues must be excised and the raw edges approximated without tension. If tension is produced by the closure, relaxing semilunar incisions to one or other side of the wound will permit closure of the defect without damaging tension. Occasionally a semilunar incision in the skin will be necessary to close the sucking wound. Wounds closed under tension will frequently lead to local infection, followed at times by a spreading phlegmon of the chest wall or by a massive empyema, and will reconvert themselves into infected sucking wounds.

A subcutaneous emphysema suggests a lacerated lung, with a fairly large open bronchus, or the temporary closure of a previ-

ously sucking wound. Emphysema that appears in the suprasternal area is usually secondary to a mediastinal emphysema which may be rapidly fatal. Relief may be obtained by a short transverse incision in the suprasternal notch with separation of tissues in the midline down to the trachea. A small soft rubber drainage tube is inserted to permit the constant escape of air.

One of the most difficult problems for proper evaluation is the degree of abdominal injury present. The line of flight of a missile may definitely exclude the abdomen. However it is surprising how frequently the rectus abdominis muscle is held rigid and is even tender on pressure, with a unilateral chest wound. When present its significance must be properly evaluated.

Several factors may enter. Evidence of injury to one or more of the lower ribs on the affected side may provide sufficient explanation. Not infrequently the diaphragm is lacerated in one or more places either by penetrating missiles of the lower thorax or by missiles traversing tangentially. Their portal of entry may be either thoracic or abdominal. Diaphragmatic splinting is aided and accompanied by upper abdominal guarding.

Upper retroperitoneal injury with bleeding into the neighboring soft tissue as well as injuries to the dome of the diaphragm may also be responsible for confusing abdominal signs. At autopsy one patient showed no evidence of intra-abdominal injury except leakage of a small amount of bile and blood into the peritoneal cavity from the lacerated dome of the liver.

Particular difficulty arises when there is only a wound of entrance into the chest and no indication of the line of flight. The spastic rectus muscle and the tender abdomen may be quite misleading and a roentgenogram disclosing the site of the missile would be most helpful in determining what structures lay in the line of flight. If the abdomen or its parietes are involved an exploratory operation to rule out a perforated hollow viscus is indicated.

If the heart is in the line of flight, aspiration for a hemopericardium or an exploration for a cardiac tamponade may be imperative. Occasionally aspiration alone is effective in controlling the tamponade. The surgical approach to the heart is best accomplished through excision of the third, fourth, and fifth costal cartilages and portions of the fourth and fifth ribs. The pericardium is incised between stay sutures, the blood is quickly evacuated and the bleeding point sought for digital closure. If not quickly found, the bleeding point may be on the posterior surface, and the heart must be lifted or rotated by a stay suture introduced into the muscular apex of the heart. It is impracticable to seize the ven-

tricular wall with clamps. Instead sutures are applied paralleling the rent and tied. The edges of an auricular wound may be seized at opposite points by clamps, and the tissue in the clamps tied together without suturing. The pericardium is loosely closed with two or three widely spaced sutures to avoid postoperative tamponade. The wound is closed without drainage.

The prophylactic use of penicillin deserves special mention. It may be given in doses of from 50,000 to 100,000 units intrapleurally following each aspiration, and intramuscularly every 3 hours in doses of 20,000 units over a period of 5 days, or longer if fever persists. Sulfadiazine 1 gm. is administered by mouth every 4 hours for an indicated period.

The administration of oxygen by nasal catheter, and multiple transfusions of whole blood aid enormously in attaining cardio-respiratory stabilization after the mechanical factors incident to a hemothorax, to a sucking wound, or to a stove-in chest have been remedied. It is increasingly apparent that early deaths on the battlefield, at the forward dressing station, and in the field hospital are primarily caused by loss of blood. Massive transfusions of 2,000 to 3,000 cc. of blood are life-saving.

Once stabilization of a chest injury has been effected, and the patient has had initial definitive care, very little active treatment is required for several days. During this interval ship and air transportation at low altitudes are well tolerated. A few patients will require oxygen or aspiration at the termination of the flight. The margin of cardiorespiratory stability may be very narrow in those evacuated soon after injury. Also a few will have progressive pleural weeping over a period of several days, which may be aggravated by changes in altitude.

Upon arrival at a secure rear hospital this group of chest injuries enters the third phase of convalescence, and receives elective definitive surgery if necessary. At this stage pooling of these patients in one institution for each active war theater offers many advantages. It is obvious that the care of chest injuries in an institution staffed by surgeons specially trained in thoracic surgery, assisted by a special operating room staff, having at their disposal apparatus for positive-pressure anesthesia, a fluoroscope and foreign-body locator, an electrosurgical unit, suction apparatus and other special thoracic instruments, would lead to a minimum morbidity and mortality.

Care and effort at this stage will be directed to such treatment as may be necessary for complete restoration of the patient to normal health. Foreign bodies will be removed and residual hemothorax and hydrothorax controlled by repeated aspiration.

Suppurative pleurisy may have provided pleural cavities requiring closure through the reexpansion of lung. This may be dependent upon proper and adequate drainage, upon evacuation by thoracotomy of infected or organized blood clot and upon the closure of a coexisting bronchopleural fistula. The use of the Eloesser skin-to-pleura flap for this latter group, often supplemented with a temporary phrenic crush, has proved most helpful. A ruptured diaphragm which has escaped attention up to this time will be repaired.

The return of the patient to duty status or evacuation to the United States may be determined at this time. In general those having serious complications, such as evidence of considerable pleural thickening, intrapulmonary damage, or suppuration, or those requiring a formidable operative procedure for the removal of a foreign body, are evacuated to the United States for further ambulatory convalescence and disposition. Experience has taught that the fibrosis incident to a laceration of the lung requires a long convalescence, with almost complete return of the lung to normal as will be evident from x-ray studies. Until then normal activity is not tolerated.

Other patients who have shown minimal signs of pleural or pulmonary damage, have been returned to duty in the Pacific theater in from 60 to 120 days.



EXCESSIVE FLUIDS AFTER SHOCK INADVISABLE

Following the shock phase, burned animals that were maintained on an intake of food identical with that consumed before injury show a decided rise in their plasma volumes above the normal. Since a state of overhydration is manifested during the convalescent phase by the increase in the plasma volume per kilogram of body weight, it does not seem advisable to give excessive quantities of fluid during the postshock period. Such an overaccumulation of fluid may undoubtedly lead to some of the so called "toxemic" deaths. Adequate urinary output should be maintained and diuresis encouraged.—ABBOTT, W. E.; HIRSHFELD, J. W.; and MEYER, F. L.: Metabolic alterations following thermal burns; changes in plasma volume and plasma protein in convalescent phase. *Surg., Gynec. & Obst.* 81: 25-30, July 1945.

SPECIAL TREATMENT WARD FOR CRITICALLY INJURED

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Recently in a Naval base hospital near a combat zone a plan was evolved for the special handling of seriously and critically injured patients. This plan proved so effective in operation that its principles might well be applied to other military and civilian hospitals. Briefly the plan was as follows.

A centrally placed ward of 23 beds was chosen for the sole purpose of giving special treatment to patients in shock or in a serious or critical condition from other cause (excluding those with infectious diseases and burns). This was known at first as the "shock ward" and later as the "special treatment ward." It was equipped with an abundance of carefully chosen supplies considered necessary for the diagnosis and treatment of shock and other extreme debilities. It was staffed by nurses and corpsmen especially trained for the job at hand.

Patients (officers as well as enlisted personnel) who were considered to be in a serious or critical condition by the admitting officer, or who became worse following an operation or while on one of the other wards, were sent immediately to this ward where they remained until such time as their retention on the serious list no longer was considered necessary. Frequently patients were "conditioned" for an operation in this ward and returned there for postoperative care. It must be emphasized, however, that this ward carried out functions other than resuscitation. Patients were retained for several days or even weeks if special nursing care and medical observation was thought to be essential. This was found to be so in the majority of patients admitted there. Between 0.5 percent and 3 percent of various groups of casualties admitted to the hospital were sent to the special treatment ward. The rate varied with the efficacy of previous care.

The officer in charge of the ward was a member of the medical service. It was his responsibility to supervise and to coordinate the various treatments and to decide when a patient had recovered sufficiently to be transferred to another ward or to the operating room. Consultants from each of the other services were on call at all times. Three other officers of the medical service were

designated as assistants to be called upon when necessary, and each of these was in charge of two emergency teams, each consisting of one nurse and two hospital corpsmen, specially indoctrinated in the treatment of shock and familiarized with the location and operation of all equipment and supplies in the special treatment ward. The permanent nursing staff consisted of two nurses and four corpsmen during the daytime and one nurse and two corpsmen at night.

Watch lists were arranged so that at least two doctors and two of the emergency teams always were available upon short notice, in addition to the nurses and corpsmen on regular duty in the ward, so that several critical cases could be received at one time.

As soon as a patient was admitted to the ward, the officer-in-charge was notified. He examined the patient immediately and carried out any necessary emergency treatment. Surgical, orthopedic, and other consultants were called when necessary, and the special care of any part (such as difficult surgical dressings, the handling of fractures, treatment of eye injuries) was carried out by a member of the appropriate department, but the general care of the patient remained the responsibility of the staff of the special treatment ward.

ADVANTAGES

The value of having a separate ward for the segregation and special treatment of nearly all of the seriously and critically injured patients was soon recognized by the members of the staff of the hospital as the plan evolved over a period of several weeks, during which approximately 7,000 recent battle casualties were being received.

The chief advantages of this plan are:

1. *Saving of valuable time in emergencies.*—Most of the supplies and equipment necessary to meet various emergencies and to treat serious and critical cases had been stocked in the special treatment ward so as to be immediately available when needed. Much valuable time was saved by not having to send a corpsman to search for such things as plasma, intravenous solutions, transfusion and infusion sets, serum albumin, oxygen, carbon dioxide-oxygen mixtures, suction apparatus, aspirating sets, syringes, needles, bandages, dressings, splints, minor surgical trays (especially useful for venous section and sternal infusions), and various ampules and drugs.

A portable x-ray unit was kept handy to the ward so that technicians could obtain bedside films upon very short notice. The x-ray department was geared for giving prompt readings on wet films.

A small laboratory set-up was maintained in a side room off the ward and a laboratory technician was on call at all times. Blood counts, urinalyses, blood cross-matchings, plasma protein levels (copper sulfate technic) and hematocrit determinations could be had within a surprisingly short time. This prompt service was of considerable help in estimating needs for additional intravenous therapy.

2. *More effective utilization of special professional skills.*—The major onus in a hospital receiving recent battle casualties falls upon the shoulders of the general surgeons, the orthopedic surgeons and the neurosurgeons. There is a great deal of tedious surgical work to be done. By fully relieving these men of the responsibility for the pre- and postoperative care of the more seriously injured cases, the internists in charge of the special treatment ward released them from a very considerable burden, thus allowing them to care for a much larger group of less serious cases.

The very natural professional instinct of medical officers is to devote maximum time and effort to patients most likely to die, and should the surgeons not be relieved of this responsibility by some such plan as has been outlined, many patients with many minor injuries, who might have been quickly cured by early surgical treatment, could become permanently crippled and unfit for further combat service.

3. *Conservation of manpower.*—In hospitals in which this special segregation of serious and critical cases is not the practice, the demands for special watches of nurses and hospital corpsmen are apt to be quite heavy, as such cases are more than likely well scattered through the various wards. Often a sufficient number of adequately trained personnel is not available day and night. By having all serious cases in one ward, fewer nurses and corpsmen are necessary for the care of an equal number of patients, and being well versed in the patients' needs, the medical officers' technics, and in the recognition of potential danger signs, it is likely that the nursing care given is superior, especially since every facility is right at hand.

4. *Improvement of morale.*—The psychic trauma which is produced in slightly wounded patients already distraught by their battle experiences when they are constantly hearing the groans of others or seeing them die is, of course, an unmeasurable factor, but no doubt an important one in retarding their recovery. The removal of the serious and critical cases from the open wards and nearby quiet rooms allows the more pleasant aspects of hospitalization to be stressed. Quicker mental and physical recovery is apt to ensue.

5. *Coordination of diverse therapeutic methods.*—In our experience, most of the serious battle casualties were produced by multiple wounds. Often it was difficult to decide whether the patient belonged more in the province of the neurosurgeon than in that of the orthopedic surgeon, or whether his treatment should be directed by a general surgeon or an ophthalmologist, and so forth. Most of the wounded were terribly fatigued upon reaching the hospital and many were quite dehydrated. An appreciable number of the more serious cases had acute "toxic-exhaustive" psychoses manifested by mania and delirium and many more had less intense psychiatric disturbances. Multiple transfusions were necessary in a high percentage of the cases admitted to this ward. These diverse therapeutic problems were handled without undue difficulty, however, by virtue of the fact that a single medical officer was responsible for the coordination of the various therapeutic measures considered necessary from his own observation, together with that of various consultants. Division of responsibility during this period of initial recovery could have been disastrous in many cases.

6. *Early recognition of complications.*—The number of medical complications which developed in the patients admitted to this ward was quite high. The following were noted in a group of 73 cases: Crush syndrome with renal failure 2; transfusion reactions 6 (one with uremia); jaundice (hemolytic and toxic) 8; sulfonamide reactions 3; serum reactions 2; pneumonia 1; meningitis 2; septicemia 1; pulmonary embolus 2; "toxic-exhaustive" psychoses 8; hysteria 2, and cerebral anoxia four.

The fact that internists were seeing these patients constantly, rather than on rare occasions when requested by consultation, probably accounts for the fact that most of these primarily medical complications were recognized in their incipiency and promptly treated. Possibly early diagnosis of these complications prevented a higher mortality rate. There were 8 deaths among these 73 patients: Massive pulmonary embolus 2; compound fracture of the skull 2; diffuse cerebral injury plus renal failure (crush syndrome) 1; renal failure due to crush syndrome (gangrene of both legs following bilateral posterior dislocation of the knees) 1; cerebral thrombosis following cervical laminectomy for removal of foreign body 1; and massive retroperitoneal hemorrhage (postoperative) one. There were very few other deaths caused by battle injuries in the hospital, and these occurred before it had been decided that all serious and critical cases should be sent to this special ward.

SUMMARY

1. A plan embodying the principle of segregation of seriously and critically wounded patients into a special treatment ward has been described.

2. Experience in operation has shown that this plan has certain advantages, among which are: The saving of valuable time in emergencies, the more effective utilization of professional skills, the conservation of manpower among trained personnel, the improvement of patients' morale, the proper coordination of diverse therapeutic methods, and the early recognition and treatment of complications.



PENICILLIN IN CORN OIL AND LANOLIN

Oral administration of penicillin suspended in equal parts of corn oil and lanolin extends the maintenance of the penicillin level in the system as determined by urine bio-assay. Measurable quantities were found from 24 to 42 hours after ingestion. Recovery of the penicillin is about five times higher than under administration in saline solution.—PERLSTEIN, D.; KLUENER, R. G.; LIEBMANN, A. J.; and DORRELL, I.: Oral administration of penicillin in corn oil and lanolin. *Science* 102: 66-67, July 20, 1945.



METHYLENE BLUE TEST IN LIVER DISORDERS

The modified methylene blue test for bilirubin in the urine, employed in a study of infectious (epidemic) hepatitis with jaundice, proved of value in the early diagnosis of pre-icteric hepatitis, in evaluating the course of the disease and in the prediction of impending relapse. Because of the simplicity of the test, it appears most useful in large scale testing during the course of an outbreak of infectious hepatitis and in installations where complete laboratory facilities are lacking.—GELLIS, S. S., and STOKES, J., JR.: Methylene blue test in infectious (epidemic) hepatitis. *J.A.M.A.* 128: 782-783, July 14, 1945.



RECTAL SURGICAL DIVISIONAL POINTS

Arbitrary definition of rectal surgical divisional points distinguishes lesions of the rectosigmoid from the rectum. Lesions whose lower visible or palpable edge is more than 10 centimeters from the pectinate line are classified as rectosigmoidal; those in which the lower palpable or visible edge of the tumor is within 10 centimeters (or less) of the pectinate line are grouped as ampullary rectal lesions. The rectum of the adult is described by anatomists as being ordinarily 13 to 15 centimeters in length.—WANGENSTEEN, O. H.: Primary resection (closed anastomosis) of rectal ampulla for malignancy with preservation of sphincteric function; together with further account of primary resection of colon and rectosigmoid and note on excision of hepatic metastases. *Surg., Gynec. & Obst.* 81: 1-24, July 1945.



SUBGROUPS OF A AND B FACTORS IN BLOOD

Landsteiner showed that all humans could be divided into four distinct groups according to blood properties. He postulated the existence of two factors, agglutinogens A and B, and according to the presence or absence of these he termed the groups O, A, B and AB.

The factor A has been found to exist in a strongly agglutinable form (A_1) and a weakly agglutinable form (A_2). The former is more common and is present in 80 percent of A or AB bloods. A still weaker form (A_3) has recently been demonstrated and there is some evidence that an irregular form of the factor B may also exist. These factors constitute the "sub-groups", and although they may cause some confusion in grouping, do not contraindicate the use of such blood for transfusion. Fortunately the corresponding agglutinins for these factors are rarely present. The agglutinin A_3 , however, has the unusual property of strongly agglutinating the cells of group O and in exceptional cases has been present in sufficiently high titer to cause fatalities when group O blood was transfused into a group A_1 , A_1B , or B patient.—GOULD, G. A.: Transfusion survey. *Roy. Canad. Nav. M. J.* 9: 2-11, June 1945.

PENETRATING WOUNDS OF THE FACE AND NECK

TENTATIVE TREATMENT

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The tentative treatment of penetrating wounds of the face and neck is divided into two main groups: (1) Those aimed at improving the general condition of the patient by replacing lost body fluids, maintaining a free airway, proper feeding, and rest; and (2) those directed to the repair of the local injury.

Injuries to the patients received aboard this ship occurred from a few hours to several days previous to their admission. Many had had expert preliminary care and all had received first-aid treatment. Their stay aboard varied from 5 to 13 days.

Maintaining a suitable airway and arresting hemorrhage were the most important measures of therapy. Frequently a tracheotomy was the first step toward a general repair, and in severe injuries to the lower jaw, floor of the mouth and neck a tracheotomy was often necessary. This operation should never be deferred until the patient is gasping and exhausted but should be performed early, when it can be done carefully and orderly. Specially trained hospital corpsmen care for tracheotomized patients aboard this ship and are expert in the use of a suction apparatus, an absolute necessity in the treatment of these patients.

The feeding problem is somewhat complicated at times because the injury may seriously interfere with swallowing. When this occurs a soft rubber French No. 10 or No. 12 catheter is gently inserted through one nostril until it is in the upper esophagus. About 1 inch of the proximal end is left protruding from the nose and fixed to the cheek. The catheter should be shifted to the opposite nostril every 2 days.

Patients with perforations of the hard palate are greatly aided in taking food by having an acrylic plate fitted to cover the defect. In fractures of the jaw the dentist wired and splinted the fragments into position; in several patients with backward displacement of a portion of the mandible, causing severe difficulty in breathing, proper splinting of the lower jaw resulted in prompt relief.

Whole blood, plasma, salt solution and dextrose were given when indicated, as were penicillin and the sulfonamide drugs. A dose of one-half cc. of tetanus toxoid was given intramuscularly to all patients not receiving it on the beach. No case of tetanus developed in the American wounded, though it was common among the wounded Japanese. In the far western Pacific, all wounds were infected with one of the pyocyaneus group.

Wounds are kept as clean as possible by daily dressings and irrigations. Fragmentation slugs burn as well as penetrate, devitalizing the tissues adjacent to the wound. Foreign bodies, pieces of loose bone, broken teeth and dead tissue are gently removed and hemostasis established. Approximation of tissues and skin is accomplished so far as possible by dressings rather than sutures. Perforations of the sinuses and hard palate are irrigated daily with sterile normal salt solution. Granulation tissue is similarly cleaned, frosted with a sulfonamide powder and freely covered with sterile vaseline and gauze dressings.

It must not be taken for granted that chemotherapy can replace sterile technic, meticulous care in dressings, or the gentle handling of tissues.

As all of the patients treated were young, healthy adults before injury and when first seen were in severe shock, their recuperative powers were still strong and active and with proper help they rapidly repaired even severe defects.

These patients should not be considered just as cases of fractured jaw, tracheal wound or perforation of the hard palate, but as individuals who, besides being wounded, are tired, depressed and frequently despairing. All that is possible should be done to bring about a feeling of safety, cheerfulness and confidence.

By these methods patients with penetrating wounds of the face and neck were delivered to our large base hospitals in good condition, with the first stage of repair begun, for their definitive treatments.

THE PREVENTION OF TRANSFUSION REACTIONS

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and

FREDERICK T. HESS

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Despite many safeguards, transfusion reactions still occur all too frequently, and as they are in most instances preventable, the necessity of exactness and accuracy in typing and cross-matching is apparent. At the Massachusetts General Hospital the incidence of transfusion reaction is recorded at 6.3 percent based on the first 4,000 transfusions. This included 1.2 percent of serious reactions as evidenced by high fever and chills, 1.5 percent of minor chill and temperature reactions, 2.6 percent explicable on an anaphylactic basis, and 1 percent which may be coincidental rather than caused by transfusion.

Four hundred consecutive transfusions given at this advance South Pacific fleet hospital have been followed by 1 moderately severe anaphylactic reaction and 4 mild anaphylactic reactions, an incidence of 1.25 percent. Many patients received multiple transfusions with increasing chances of transfusion reactions. The incidence of multiple transfusions is recorded in the following table.

Incidence of multiple transfusions

Type	People receiving 2 or more transfusions	Number of multiple transfusions	Total number of transfusions
AB.....	7	25	30
A.....	33	116	150
B.....	10	33	46
O.....	34	125	174
Total.....	84	299	400

The procedures used in this hospital in the prevention and study of transfusion reactions may be summarized as follows:

The donor list.—A donor list of 125 was established from hospital personnel before the hospital opened. The blood groups were distributed as follows: 50 group O, 50 group A, 15 group B, and 10 group AB.

A careful history of each prospective donor rules out malaria, venereal disease, blood dyscrasia, infectious diseases, and allergic conditions. A negative Kahn test is required within 10 days prior to each donation of blood and a physical examination is done immediately before donation. All donors must be in a fasting state, that is without food for 6 hours. Donors are not re-entered on the active list until a lapse of 3 months has occurred following the last donation of blood.

Cleaning of transfusion equipment.—Rubber tubing and glassware are washed in soap and water immediately following use. The tubing is treated with 1 percent sodium hydroxide, both tubing and glassware are rinsed thoroughly with tap water and with 2,000 cc. of distilled water, followed by normal saline, after which it is autoclaved. Filters are allowed to stand in concentrated nitric acid for 6 hours and then cleansed with tap water, distilled water and lastly normal saline solution before autoclaving.

Cross-matching.—One well-trained technician is assigned to this important procedure and is on call day and night for emergency work which obviates the employment of inexperienced hands. Only typing sera of high potency are used and these are frequently tested against known cells. Blood grouping is performed on both donor and recipient and only blood from homologous groups is used. The regrouping of both donor and recipient is important inasmuch as the group listed on identification tags is found to be erroneous in 12 percent. Facilities for typing for the Rh factor are not available to hospitals in this area. Accordingly cross-matching is carried out by the modified Landsteiner-Levine technic, as an added precaution against Rh incompatibilities. The serum is inactivated at 56° C. for 10 minutes to prevent hemolysis and clouding of the reaction. One drop of the serum to be tested, 2 drops of a 2-percent red cell suspension, and 1 drop of normal saline solution are placed in Kahn tubes and mixed. Three tubes are set up, donor's cells—patient's serum, patient's cells—donor's serum, and patient's cells—patient's serum; the latter tube acts as a control for auto-agglutination. The tubes are placed in the incubator at 37° C. for 1 hour. The tubes are then centrifuged at 500 rpm, for 1 minute, examined microscopically for hemolysis, and resuspended and examined microscopically for agglutination.

COMMENT

A transfusion reaction is best treated by prevention. Accordingly, despite great care used in the selection of a donor, the recipient should be carefully observed by the surgeon in charge

of the transfusion during the administration of the first 100 cc. of blood. If there is any complaint, however trivial, the transfusion should be discontinued.

With transfusion reactions urinalyses are immediately done, including tests for albumin, hemoglobin, red corpuscles, and hematinic casts. The blood is also examined immediately and again in 12 hours for a significant increase in serum bilirubin.

Hemolytic reactions following transfusions in which donors have been of the same type as the patient have occurred fairly frequently in the past. This has been especially true when large numbers of patients have received multiple transfusions. Landsteiner and Wiener¹ in 1940 discovered that the serum of rabbits immunized against the blood of the *Macacus rhesus* monkey agglutinated the blood cells of 85 percent of humans. This new factor was called Rh after the rhesus monkey in which it was first discovered. When blood which is Rh+ is given to a patient who is Rh—, anti-Rh agglutinins may develop. In studying hemolytic reactions following previously uneventful transfusions, and in which blood of homologous type was used, it was discovered that the recipients had developed anti-Rh agglutinins. On again receiving blood from an Rh+ donor a hemolytic reaction developed.

The same mechanism was found responsible for hemolytic reactions following the first transfusion in pregnant women. This has been explained by the presence of the Rh factor in the blood of the infant to whom it was transmitted by the father as a Mendelian dominant character and its passage through the placenta to the maternal circulation, where it acted as an antigen in the production of anti-Rh agglutinins. It was postulated² on this basis, that erythroblastosis foetalis may be caused by a similar mechanism and that the anti-Rh agglutinins pass through the placenta from maternal to fetal circulation producing hemolysis of fetal blood.

There are, therefore, three definite indications for the use of Rh-blood, an infant with erythroblastosis foetalis, an Rh-pregnant woman, and an Rh-patient who has received previous transfusions from an Rh+ donor.

Naval hospitals in this area do not have access to Rh-typing

¹ LANDSTEINER, K., and WIENER, A. S.: Agglutinable factor in human blood recognized by immune sera for rhesus blood. *Proc. Soc. Exper. Biol. & Med.* 43: 223, January 1940.

² LEVINE P.; BURNHAM, L.; KATZIN, E. M.; and VOGEL, P.: Role of iso-immunization in pathogenesis of erythroblastosis foetalis. *Am. J. Obst. & Gynec.* 42: 925-937, December 1941.

serum. In cross-matching for multiple transfusions on many persons at this activity, 6 incompatibilities which could be ascribed to the Rh factor have been observed. Several of these proposed transfusions were not definitely essential, and were omitted. In two instances it was necessary to obtain compatible donors and these were not obtained until 12 and 18 cross-matchings respectively were set up.

SUMMARY

1. Four hundred consecutive transfusions have been given without a serious transfusion reaction.
2. The procedure used in cross-matching is one designed to elicit all types of incompatibility, including Rh.
3. Six apparent Rh incompatibilities have been observed in cross-matching for multiple transfusions among 84 persons.
4. Methods of studying transfusion reactions are described.



EFFECT OF INFECTION ON SHOCK

The inoculation of virulent cultures of *Streptococcus haemolyticus* and *Clostridium welchii* into the thigh muscles just before application of the Blalock crusher modifies the resulting shock. The survival time of animals inoculated with *Str. haemolyticus* is two hours less than the control animals and those inoculated with *Cl. welchii* survive three hours less than the controls. *Staphylococcus aureus* injected into the thigh muscles before injury does not alter the survival time under the conditions of the experiments. There was no greater fluid loss in the infected animals than in the controls, and the decreased survival time was considered to be due to the infection of traumatized muscle and to circulating bacterial toxins. The infected animals do not have a secondary rise in blood pressure following the primary fall.—MAHONEY, E. B.; HOWLAND, J. W.; and YACKEL, K.: Role of infection in shock produced by muscle injury. *Surgery* 17: 805-815, June 1945.

CLINICAL NOTES

SARCOMA OF RECTUS MUSCLE: SURGICAL MANAGEMENT

REPORT OF A CASE

HERBERT L. PUGH

Captain (MC) U.S.N.

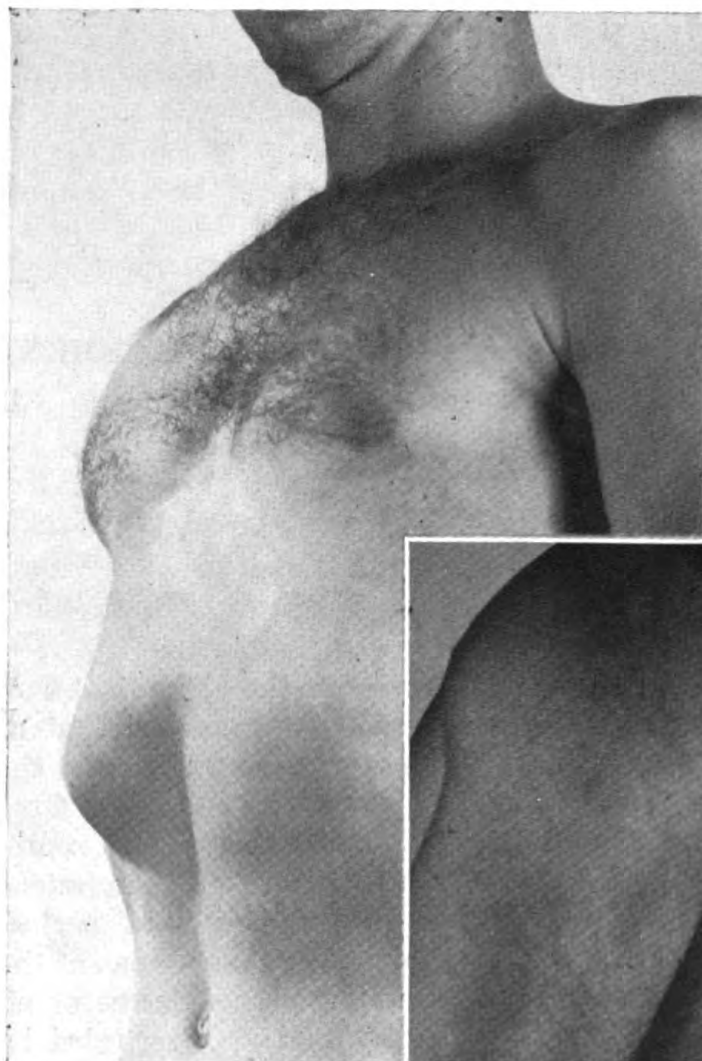
and

AUSEY H. ROBNETT

Lieutenant (MC) U.S.N.

The literature dealing with malignancies of the abdominal wall is relatively sparse. Meade and Brewster (1) reported that of 296 tumefactions seen on their service over a 3-year period at the Charity Hospital and Touro Infirmary, New Orleans, only three were neoplasms of the abdominal wall. These three cases represented an incidence of 0.2 percent of the 1,460 total admissions to the tumor clinics of these institutions during that period. Gurlts (2) in 1924 reported 13 carcinomas and 14 sarcomas of the abdominal wall in a total of 16,637 consecutive neoplasms of all types. Of the tumors involving the abdominal wall recorded by von Klot (3) in 1921, 248 were fibromas, 67 fibrosarcomas, 17 fibromyxomas and 60 sarcomas. One was an endothelioma, one an angioma, and one an angiosarcoma.

Neoplasms of the abdominal wall are most commonly mesodermal in origin, over 50 percent being fibromas, with fibrosarcomas and sarcomas also occurring in appreciable percentages (4). Myxosarcomas rarely have been noted among these tumors. This may be the result of an actual rarity of occurrence, or it may be a consequence of the different interpretations which are likely to obtain in sarcomatous tumors. Some pathologists maintain the myxomatous areas represent degeneration of the more adult tumor cells, and therefore report the tumor in accordance with the nature of the adult tissue. The opposing school, feeling that the myxomatous areas represent a co-existing tumor, report the tumor as such. There is, however, a general concurrence in pathology texts that these tumors tend to recur locally and upon recurrence tend to take on the full-fledged characteristics of a malignancy.

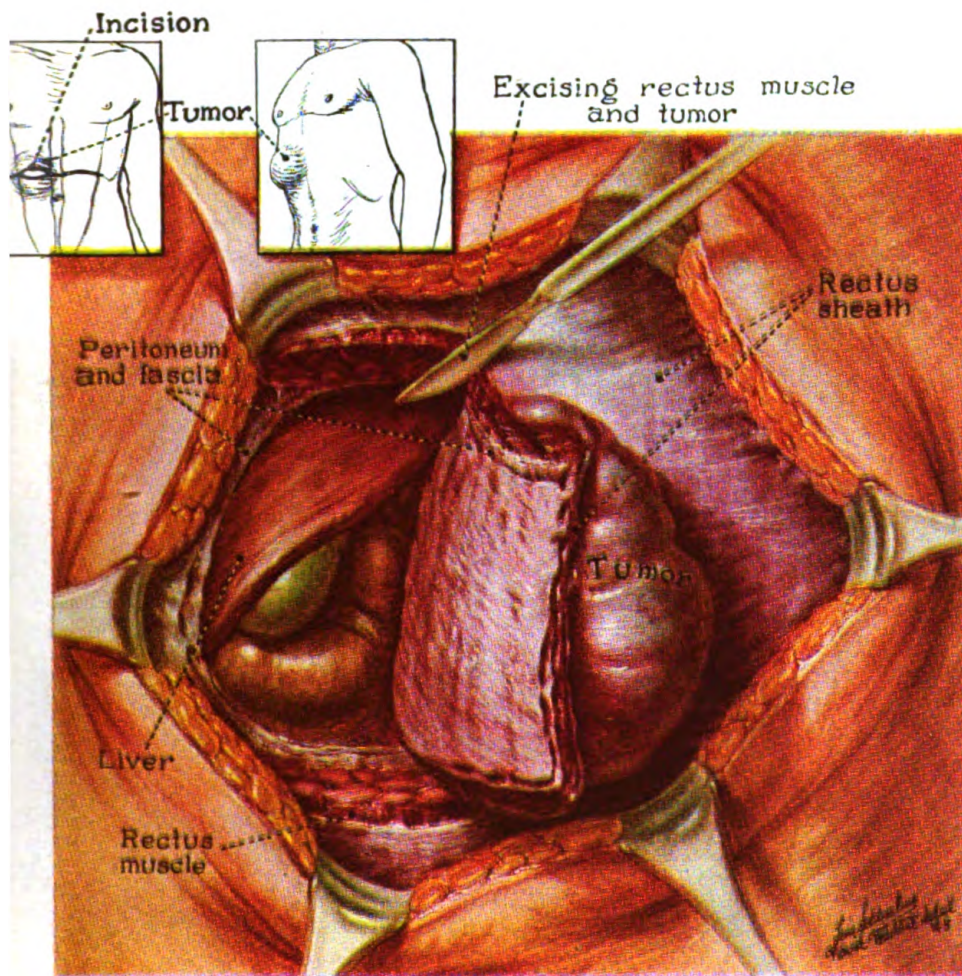


1. Sarcoma, right rectus muscle, oblique view.

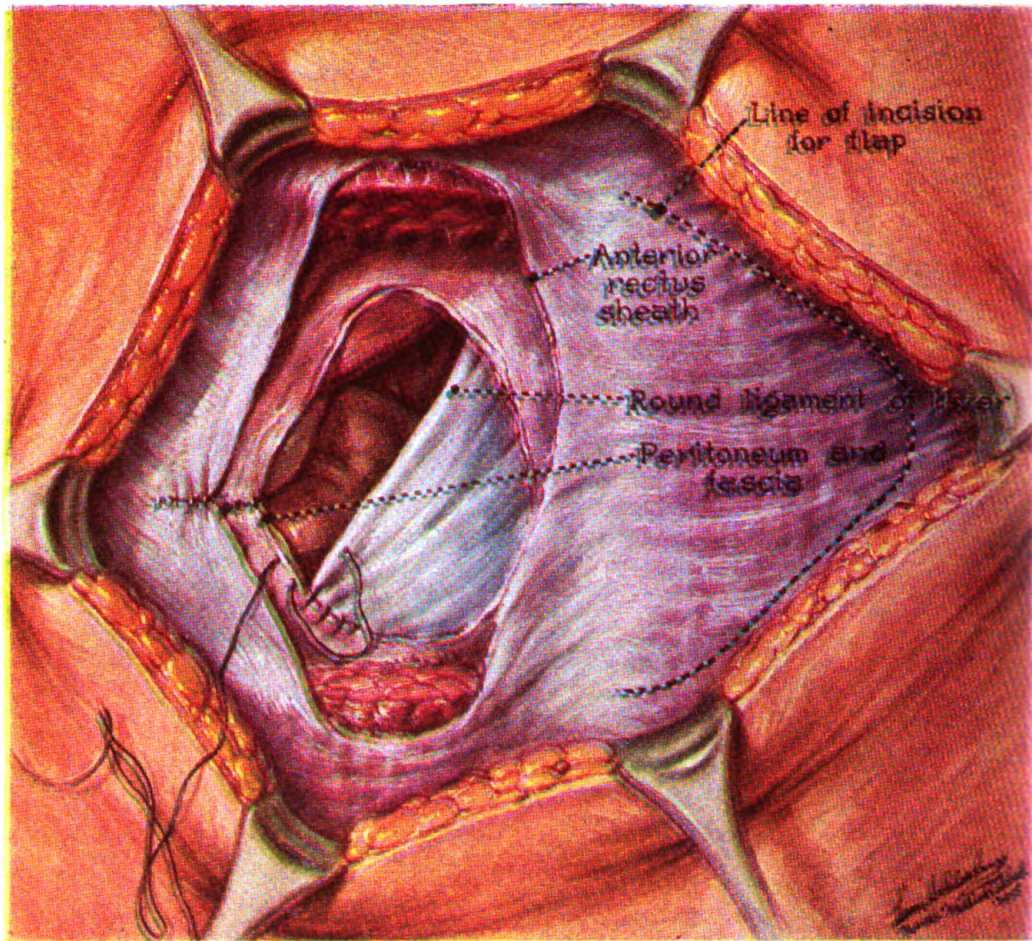


2. Sarcoma, right rectus muscle, lateral view.

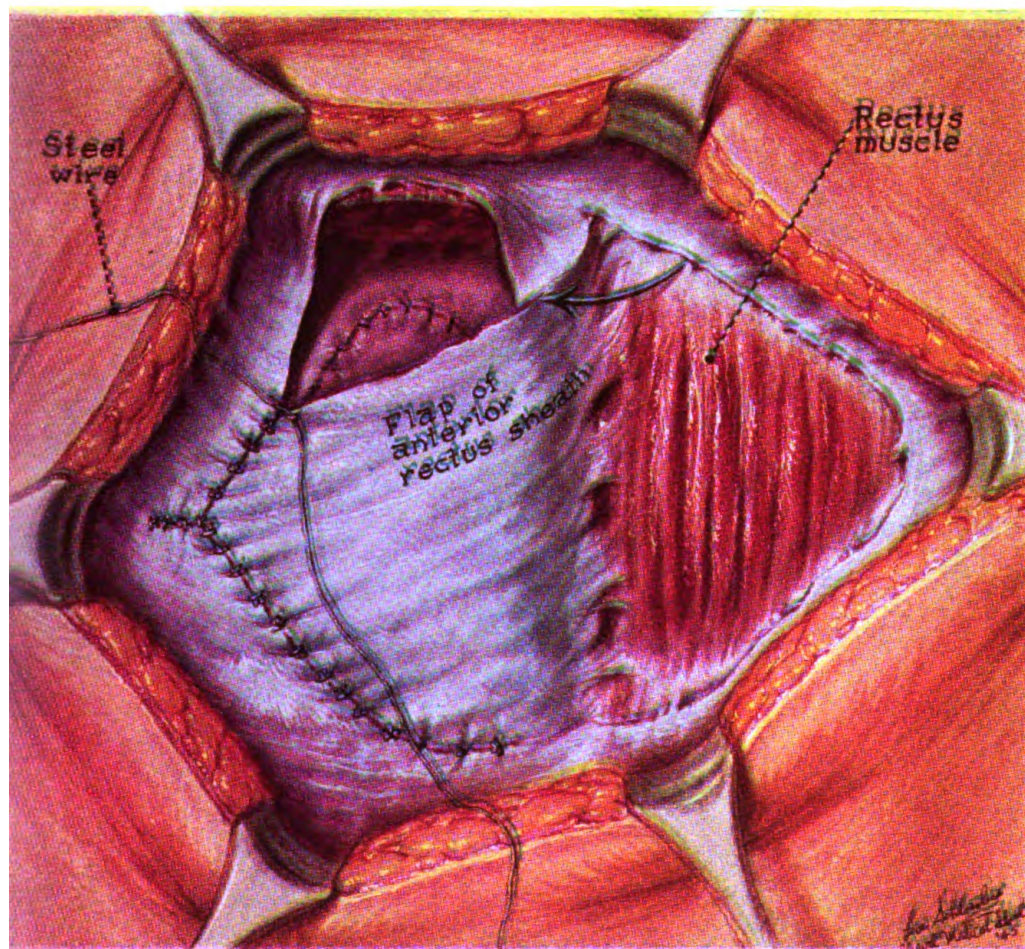
Neoplasms of the rectus muscle and its sheath are of particular interest among tumors of the abdominal parietes, for the tendency to local recurrence with subsequent malignant change necessitates



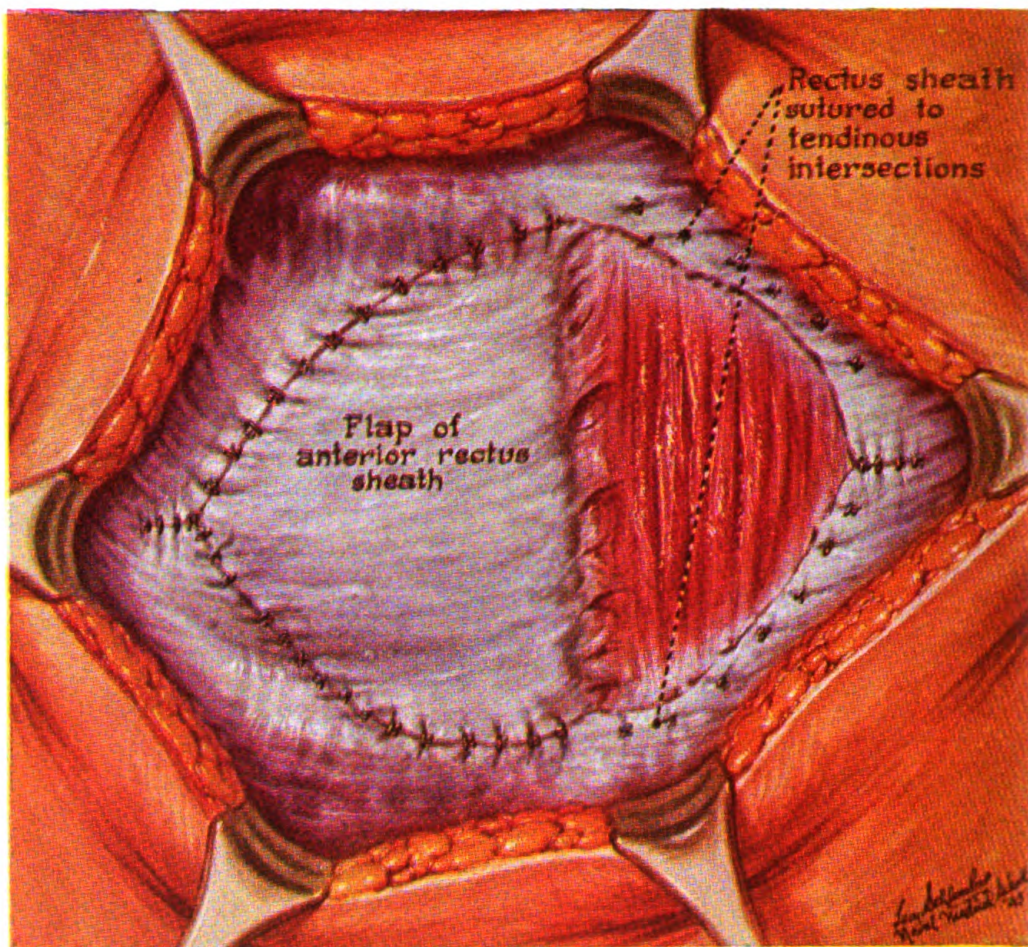
3. Excision of sarcoma, right rectus muscle including anterior and posterior sheaths and adjacent peritoneum.



4. Closure of hiatus in peritoneum by utilization of round ligament of liver.



5. Fortification of weakened area in abdominal wall by use of fascial flap from opposite side.



6. Fascial repair completed.

wide surgical removal (5). This procedure often leaves a large defect in a zone subject to much strain, and therefore the defect requires extensive plastic repair.

A case of myxosarcoma of the rectus muscle is presented here. The complete removal of the neoplasm necessitated resection of a large portion of the rectus muscle, the sheath, and the underlying parietal peritoneum. The repair, involving the reconstruction of the abdominal wall, is of special interest because of the satisfactory anatomic and functional result that was obtained, as shown in the accompanying illustrations.

Case report.—The patient was admitted to the U. S. Naval Hospital, San Diego, California, in apparent good health, complaining only of a painless swelling in the upper portion of the abdomen. This swelling had first been noted 2 months prior to admission, and since then had increased to the size of a baseball, but at no time was it tender. There was no history of associated trauma or familial conditions of a related nature.

Examination revealed a large mass, the size of a baseball, lying at the junction of the upper and middle thirds of the right rectus muscle. The mass, which was not attached to the overlying skin, lay in the rectus muscle and was superficially distinct in outline, with a broad ill-defined base. The mass was not tender and moved with contraction of the rectus muscle. No weakness of the abdominal musculature was noted. The remainder of the examination, including roentgenographs of the chest, yielded negative findings. The clinical impression was sarcoma of the rectus muscle.

Through a transverse skin incision over the tumor mass, the segment of the right rectus muscle containing the tumor and including the anterior and posterior sheaths and peritoneum, was excised in its entirety. The peritoneum was closed by freeing the round ligament of the liver and reflecting it across the hiatus in the peritoneum. The weakened area of the abdominal wall, incident to the removal of this mass of muscle and fascia, was reinforced by a triangular flap of rectus sheath reflected across from the left side and sutured to the divided sheath of the right rectus and to the excised fascia of the obliquus externus muscle. Interrupted cotton sutures were used in the peritoneum and steel wire in the fascia. The divided anterior sheath of the left rectus muscle was sutured to the tendinous inscriptions of that muscle. The skin was closed with interrupted cotton sutures in both the subcutaneous and cutaneous layers.

The department of pathology reported the tumor mass to be irregularly 6 cm. in diameter, appearing to be completely encapsulated. The cut surface showed gray, mucoid tissue with scattered rounded nodules up to 1.5 cm. which were firmer and lighter in color. Microscopically the soft mucoid areas were composed of myxomatous tissue. The firm areas were somewhat more cellular and contained rather numerous multinuclear tumor giant cells. These areas were thought to be confirmatory of myxosarcoma and it was so regarded; however the malignancy was considered to be of a low grade.

The patient's postoperative convalescence was uneventful. He was allowed up and about on the tenth postoperative day.

One month after surgery the patient, fully ambulatory, was performing light duties about the ward. A palpable deficiency of the superior portion

of the right rectus muscle was present. However the abdominal wall was firm and the patient was unaware of any particular muscular loss. He was surveyed to limited duty to return in 6 months for determination of fitness for full duty, and at the time of that examination he presented no encumbrance sufficient to interfere with his ability to perform the usual duties of his grade in the Navy. There has been no evidence of recurrence after 1 year.

SUMMARY

1. The literature bearing upon abdominal wall tumors is reviewed.
2. A case of myxosarcoma of the right rectus muscle is reported.
3. The technic of removal of this tumor and plastic repair of the abdominal wall is described.

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QUININE IN RESPIRATORY INFECTIONS

A review of the literature over the last 50 years indicates the value of quinine as an important agent in the prophylaxis and treatment of colds and influenza. Its antipyretic and analgesic action are well known. In virus pneumonia, patients have responded more favorably to quinine than to any other medication. While its mode of action has not been satisfactorily explained, its empiric value is definite.

In view of the dangers of epidemics of virus pneumonia and influenza, it is well to take this occasion, when so much attention is focused on the sulfonamide drugs and penicillin, to remind the profession that these newer medications are not panaceas and that a useful, active agent such as quinine could be widely used with great benefit.—FEINBLATT, H. M.: Quinine in treatment of respiratory tract infections. *Indust. Med.* 14: 517-522, June 1945.

DYSTROPHIA MYOTONICA

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Dystrophia myotonica is a heredofamilial disease characterized by a tonic spasm of the involved muscles which renders them incapable of being relaxed immediately after contraction. The spasm occurs after voluntary muscular contraction or mechanical or faradic stimulation. Pathologically the muscles exhibit atrophy and degeneration of the cellular cytoplasm with diffuse interstitial fibrosis. Due to atrophy, the facies appears hollow and masked. Associated with the slowly progressive muscular atrophy of the affected muscles are signs of various endocrine and metabolic dysfunctions such as impotence, bilateral cataracts, increased secretion of tears, and alopecia. In some cases there is degeneration of the posterior columns of the spinal cord and absence of deep tendon reflexes.

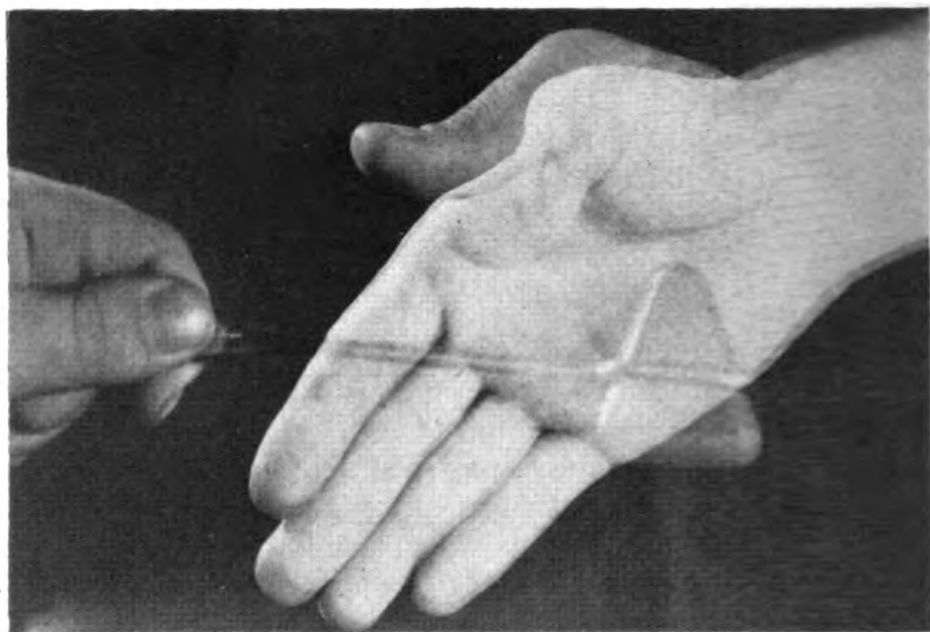
Early in the course of the disease, patients may present themselves with various predominant symptoms and may first be seen by the ophthalmologist because of cataracts, by the internist because of endocrine changes, by the urologist or psychiatrist because of impotence, or by the neurologist because of symptoms referable to the nervous system.

The following cases are presented to direct attention to this disease, which early in its course is frequently mistakenly diagnosed as a functional disorder.

CASE REPORTS

Case 1.—This patient was admitted to the hospital because he complained of progressive weakness of his hands, legs, and feet, of approximately 15-month duration. During the previous 12 months he had had difficulty in holding a wrench and in writing. He had also noted defective visual acuity and slight alopecia.

On admission he exhibited a hatchet-like (myopathic) facies and *bouche de tapir*, bilateral steppage gait (partial foot drop), weakness of the hand grip, depressed deep tendon reflexes of the upper extremities, hypoactive knee jerks, and active ankle jerks. Testicular atrophy was present. There was also a definite myotonic reaction of the hands and tongue, but coordination and sensation were normal. Once his hands were clenched, the patient had difficulty in opening them; however if he continued to open and close them they limbered up somewhat.



1. A double exposure illustrating the marked myotonic reaction produced by lightly striking the thenar eminence.

Mechanical irritability of the involved muscles was high, and myo-edema was present. The myotonic reaction could be best elicited by tapping the thenar and hypothenar eminences (fig. 1). Muscular dystrophy was most pronounced in the facial, sternocleidomastoid, and forearm muscles. The cranial nerve functions were normal except for a myotonic reaction of the tongue. Fundoscopic examinations revealed a moderately large posterior capsular opacity, with several associated punctate capsular opacities spread throughout. X-ray examination of the chest yielded essentially negative results.

Quinine was administered and the patient exhibited improvement in that the finger movements were performed with great dexterity and the myotonic reaction was somewhat diminished. The general progression of the disorder was not apparently influenced to any appreciable degree.

Case 2.—A 22-year-old coxswain was first admitted to the sick list on 10 May 1944, complaining of stiffness of the hands, which had become progressively more severe during the past 20 months. He stated that in August 1942, he was handling a line which was being fed into a winch and because he was unable to release the line, was almost drawn into the winch. He also noted that his fingers lacked the dexterity required to manipulate his boatswain's pipe successfully.

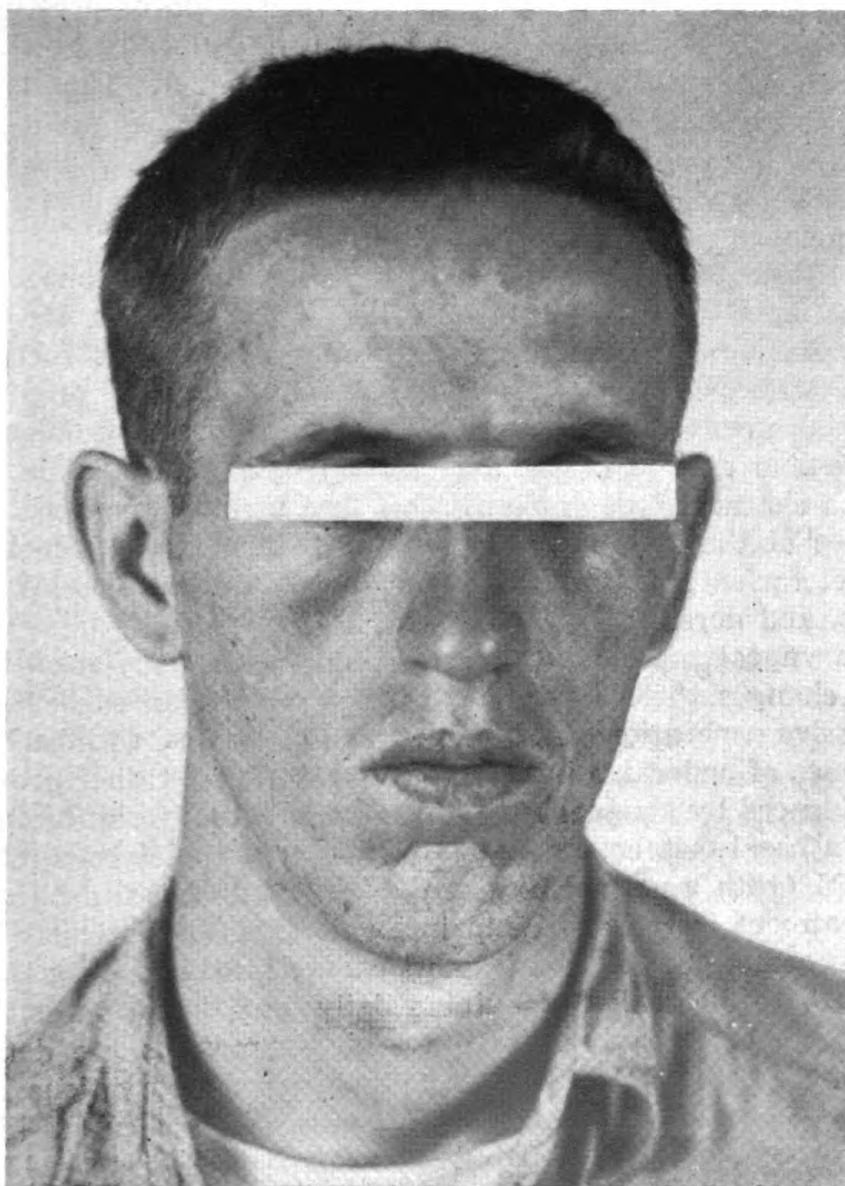
Physical examination revealed a typical hatchet facies (fig. 2), and a manual muscular hypertonicity which rendered him incapable of readily releasing a firmly held object. A myotonic reaction to percussion of the thenar eminence and tongue, resulting in definite and sustained muscular contraction, was present. This was associated with extensive atrophy of the left testis, a basal metabolism rate that varied between -20 and -30 , and a myo-edema on percussion of the involved musculature. Sensation, coordination, and cranial nerve functions were normal, except for myotonic reaction of the tongue. Electric reactions of the upper extremities diminished pro-

gressively from the proximal to the distal region, and there was a myotonic muscular reaction to the electric stimulant.

This patient exhibited subjective improvement under quinine therapy, which, however, failed to alter the objective progress of the disease.

Case 3.—This 31-year-old seaman, second class, was admitted to the hospital because of complaints of pain and weakness in the right shoulder, and "clumsiness" of the right hand, of 6-month duration.

Neurologic examination showed atrophy which was confined to the first interosseus space of the right hand, inability readily to open the hand after making a fist, and a definite myotonic reaction obtained by percussion of the right thenar eminence and the tongue. These findings were associated with inconstant areas of hyperesthesia of a functional character. Results of a blood Kahn test, urinalysis, and complete blood count were essentially negative.



2. The hollow, masklike facies, with tendency to pouting of the lips (*bouche de tapir*).

The atrophy in this case was rather sharply localized, even though a myotonic reaction was obtained by percussion of the tongue and the normal-appearing left thenar eminence, thus indicating a more generalized involvement. Subsequently a much more pronounced myotonic reaction of the left hand with marked spasticity developed, indicating a rather rapid progression of the disorder. He was given quinine therapy, but refused to continue with it because of nausea.

COMMENT

The disturbance of muscular contraction in this disease is rather characteristic, in that the difficulty in muscular relaxation is decreased by repeated contractions and also by the administration of quinine and to some extent by epinephrine and calcium. The spasticity is increased by the administration of prostigmine. The myotonic reaction can be produced mechanically by striking the involved muscle with a percussion hammer. This is most easily demonstrated in the thenar eminence, thus producing a flexion of the thumb (fig. 1) or by striking one side of the tongue and thus producing a contraction with subsequent deviation of the tongue.

As illustrated in the above cases, dystrophia myotonica is insidious in onset, slowly progressive, and varied in its initial manifestations. Some patients exhibit only cataract formation, which may or may not be followed years later by progressive muscular involvement. The usual initial symptoms, however, are progressive muscular weakness and atrophy which tends to assume a characteristic pattern. This first becomes manifest in the muscles of the face (resulting in the hollow sunken cheeks and hatchet facies), the sternocleidomastoids, forearm muscles, quadriceps, and dorsiflexors of the foot.

Pharyngeal muscle involvement may also occur, resulting in voice changes. The disease tends to appear at an earlier age in successive generations, and to become more severe with each case. Evidence of endocrine involvement is frequently rather profound, as evidenced by gonadal atrophy which eventually results in sterility; a basal metabolism rate which frequently descends to levels of -25 (with a normal blood cholesterol); and loss of hair.

Treatment is rather disappointing in that the muscular weakness is somewhat relieved in most cases by the administration of from 15 to 30 grains of quinine daily, but the progress of the disease is not arrested. The muscular symptoms are definitely increased by the use of prostigmine. These observations are in accordance with the theory that quinine exerts a curare-like action on the motor end-plates, associated with decreased motor tone. Prostigmine promotes impulse transmission at the myoneural junction and exacerbates the existing spastic tendency.

BUNDLE-BRANCH BLOCK IN QUININE POISONING

REPORT OF A CASE

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The use of large doses of quinine orally and intravenously in the treatment of malaria makes it worth while to record instances of quinine toxicity. The drug is stated to be taken rarely for suicide and it is believed that most of the reported cases of poisoning have occurred in women who took the drug to produce an abortion. In these cases, amblyopia has been the predominant clinical feature.

The cardiac manifestations of quinine poisoning have rarely been noted. The closely related drug, quinidine, has been used in place of quinine in cardiac therapeutics since Wenckebach revealed its greater effectiveness, but qualitatively the action of the two drugs is similar. Experimentally quinidine has been shown to produce, first, a delayed intraventricular conduction, and then a bundle-branch block as the dose was increased.

In a comparison of the effects of quinine and quinidine on the electrocardiogram, Sagall and his associates¹ showed that in 68 tests, all the subjects manifested prolongation of the QT interval, depending on the dose of quinidine given. The peak effect occurred in from 2 to 5 hours after ingestion of the drug and varied from an increase of 0.025 second with 3 grains to 0.065 second with 1 gram. Quinine was only one-third as effective as quinidine in prolonging the QT interval, 5-grain doses of quinine resulting in a delay of 0.01 second, while 5 grains of quinidine caused a 0.03-second delay. Gold and his coworkers² showed that in the unanesthetized dog, intravenous quinidine produced fairly constant prolongation of the QRS complexes as well as sinus tachycardia.

¹ SAGALL, E. L.; HORN, C. D.; and RISEMAN, J. E. F.: Studies on action of quinidine in man; measurement of speed and duration of effect following oral and intramuscular administration. *Arch. Int. Med.* 71: 460-473, April 1943.

² GOLD, H.; OTTO, H. L.; and SATCHWELL, H.: Use of quinidine in ambulatory patients for prevention of paroxysms of auricular flutter and fibrillation; with especial reference to dosage and effects on intraventricular conduction. *Am. Heart J.* 9: 219-237, December 1933.

It is apparent from these observations that the major action of quinine and quinidine on the heart is to depress myocardial conduction. A delayed QT interval is a lesser degree of this depression, while delayed intraventricular conduction and bundle-branch block are evidences of greater myocardial depression.

Case report.—A WAVE hospital apprentice, second class, age 27 years, entered the office of the Officer of the Day at 0030 on 22 August 1944, 50 minutes after swallowing 150 grains of quinine. She had been having difficulties of a romantic nature and an hour before had been told it was "all off." She was acutely upset and impulsively took the quinine which she had been saving for weeks. On admission she was conscious but hysterical, incoherent, ataxic, and crying "let me die." She required assistance to stand, crumbling if allowed to take a few steps.

There was no cyanosis or dyspnea. The temperature was normal. The skin was cool and moist. The pupils reacted well to light and the fundi were normal. The ear, nose and throat examination did not disclose any abnormalities. There was no tremor of the tongue or extended fingers. The mucosa was normal in appearance. The thyroid was not enlarged. There was no significant adenopathy. The lungs were clear, with good equal expansion; there was absence of dullness and râles and the breath sounds were normal. The heart was not enlarged.

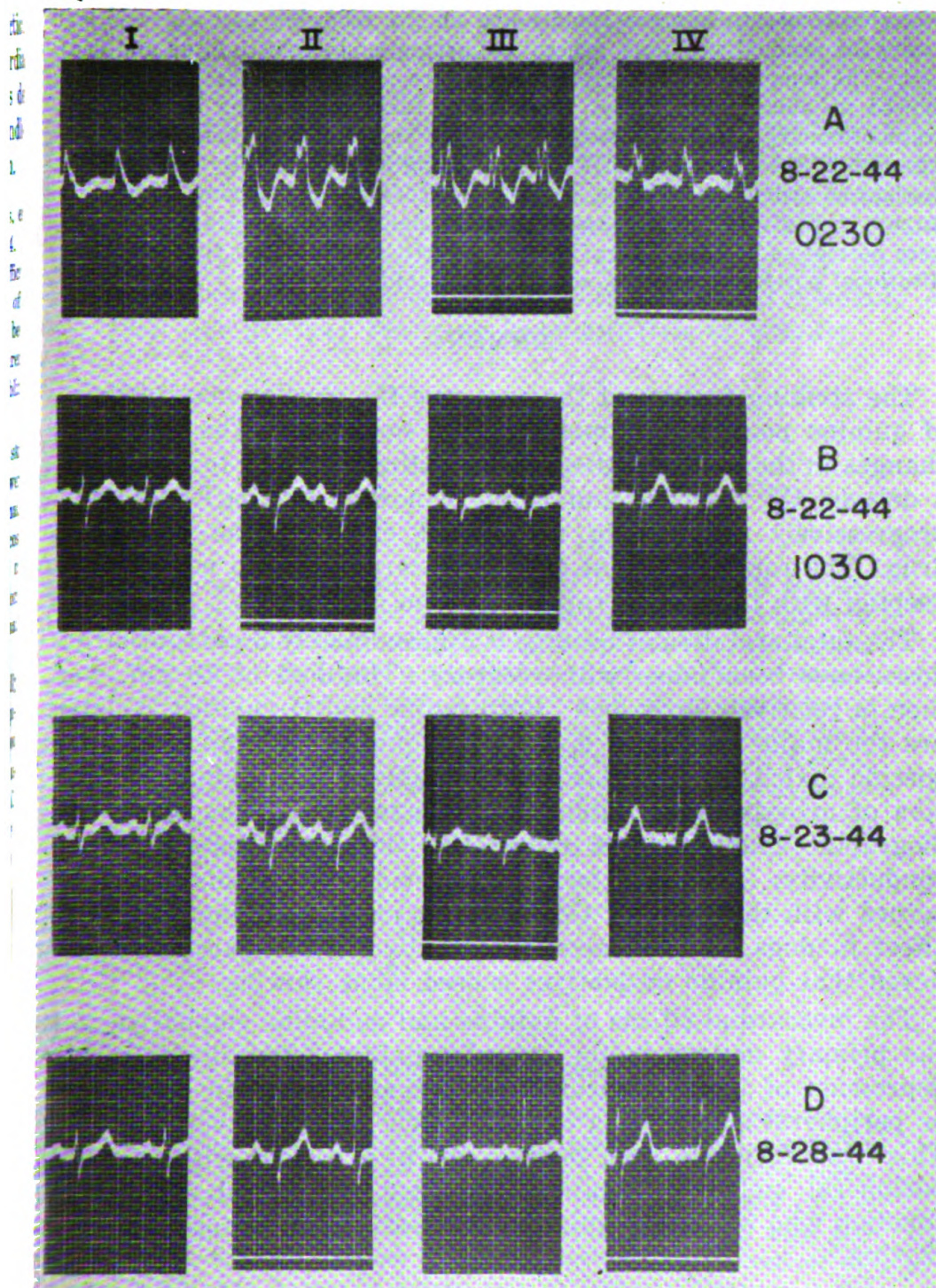
The heart sounds were rapid and regular (154 per minute), but gradually decreased with right carotid sinus pressure. The rate slowed with deep inspiration and varied on change of posture. There were no murmurs. The blood pressure was 112 millimeters of mercury systolic and 58 diastolic. There was no pulsus alternans or gallop rhythm. The peripheral pulses were all normal. The abdomen showed a well-healed appendectomy scar. There was no tenderness or abdominal spasm, and no organs or masses were palpable. The extremities were normal, and the deep reflexes were normal.

Repeated attempts were made to pass a stomach tube, but the patient vigorously resisted all efforts in this direction. Copious and repeated emesis was induced at 0100 by encouraging the patient to swallow large quantities of salt and soda. Following these episodes the patient became much quieter, but complained bitterly of "bells in her ears" and difficulty in hearing. Despite her alleged hearing difficulty, she had no trouble in following ordinary conversation. She had no visual symptoms.

An electrocardiogram taken at 0230 revealed evidence of a sinus tachycardia with a bundle-branch block. At this time the urine was normal, the white blood cell count was 13,030, with 2 percent juvenile cells, 6 percent band forms, 66 percent segmented cells, 23 percent lymphocytes, and 3 percent eosinophils. The blood sedimentation rate was 15 mm. in 1 hour. The blood Kahn test was negative.

At 0830 the patient was quiet in bed, complaining of great fatigue and weakness, loud buzzing in the ears and decreased hearing, and moderately severe abdominal cramps with "sour stomach." At no time were there visual disturbances. Results of physical and cardiac examinations were entirely negative except for the debilitated appearance of the patient. The cardiac rate was 110 beats per minute, and the blood pressure was unchanged.

A second electrocardiogram taken at 1030, 8 hours after the first, showed evidence of a sinus tachycardia, with normal appearing QRS complexes, but with a QT interval of 0.40 second (the upper limit of normal is 0.33 second).



These electrocardiograms illustrate progressively decreasing effects of quinine on myocardial conductivity.

- A.** Three hours after ingestion of 10 gm. of quinine. Sinus tachycardia with bundle-branch block.
- B.** Eight hours later. Sinus tachycardia with delayed QT interval (0.40 second).
- C.** Twenty-four hours later. Normal tracing record.
- D.** Five days later. Normal tracing record.

She continued to improve rapidly and on the following day she was well except for residual weakness, generalized aching, and slight tinnitus and deafness. The temperature and respirations were normal. Cardiac examination showed no abnormality except for a sinus tachycardia. The electrocardiographic reading was completely normal at this time, 36 hours after the ingestion of the quinine, the QT interval being 0.32 second. By the next day she had no symptoms or signs, and follow-up electrocardiograms made on 28 August and 27 September showed normal findings. Audiographic findings were normal on 26 September. The psychiatrist's note at this time was "constitutional psychopathic state, emotional instability."

COMMENT

The striking feature of the case was the cardiac manifestation of quinine poisoning. Amblyopia did not occur. The successive changes in the electrocardiographic findings (bundle-branch block, a delayed QT interval, and finally a normal tracing) indicate a progressively diminishing myocardial effect of the depressing drug. The rapid return of the electrocardiogram to normal is in keeping with the known rapid excretion of quinine.

The fatal oral dose of quinine is approximately 8 gm. but larger doses have been taken with recovery. The dose of 10 gm. was, then, a relatively large one. Respiratory and circulatory collapse are the major causes of death from quinine poisoning, and the specific toxicity for the heart is probably due to quinine depression of myocardial irritability and conductivity. The electrocardiographic changes noted reflect this depression of myocardial conductivity. The sinus tachycardia evidenced in this case is in accord with the work of Gold and his associates who noted this effect in dogs and commented that other investigators had believed that quinine derivatives caused sinus slowing.

The myocardial effects of quinine and quinidine emphasize that the primary danger in the use of quinidine clinically is in the depression of intraventricular conduction and not in pulmonary or peripheral embolism, a hazard which has been overestimated. This has previously been pointed out in a patient with repeated peripheral emboli, auricular fibrillation, and good myocardial function who was given quinidine successfully to restore a normal rhythm.³

SUMMARY

A case of poisoning with 10 gm. of quinine in a 27-year-old WAVE is reported. The major manifestations of toxicity, in addi-

³ SOKOLOW, M.: Quinidine in treatment of benign auricular fibrillation with repeated emboli; report of case. *Am. Heart J.* 18: 494-499, October 1939.

tion to the usual symptoms of cinchonism, occurred in the heart. Sinus tachycardia, bundle-branch block, and later a delayed QT interval, were the electrocardiographic findings. No cardiac symptoms or signs were noted on physical examination except for sinus tachycardia. The depression of myocardial conductivity by quinine is emphasized, and although the cardiac effects of quinine are only one-third those of similar doses of quinidine, the action of the two drugs is qualitatively similar. It is believed that electrocardiographic studies should be made in patients (especially of the older age groups) receiving large amounts of quinine.



DISORDERS OF STOMACH WITH CHEST SYMPTOMS

Among cases reported demonstrating disorders of the stomach with predominant chest pain were a patient with perforation of hiatal hernia, a man with mild angina pectoris who subsequently developed violent pain in the chest and left arm due to cascade deformity of the stomach, a woman with severe postoperative chest pain due to intermittent obstruction of the gastrojejunal communication, and a patient with genuine "acute indigestion" (due to dietary indiscretion) simulating myocardial infarction.—HARRISON, T. R.: Clinical aspects of pain in chest; pain arising from stomach. *Am. J. M. Sc.* 209: 771-783, June 1945.



VACCINE AGAINST DENGUE

It has been demonstrated that dengue virus can be propagated by intracerebral inoculation in mice. Although initial adaptation to the mouse is a tedious and difficult process, 16 consecutive passages have been achieved already in one series and further passages are in progress. The virus propagated in mice produced dengue in human volunteers, but was not pathogenic for cotton rats, hamsters, guinea pigs or rabbits. Although it was evident that even after 2 serial passages in mice the virus produced a modified type of disease in human beings, tests with the seventh, ninth and tenth passage material indicated that the modification had become so marked that it could be used as a vaccine for the production of immunity against dengue.—SABIN, A. B., and SCHLESINGER, R. W.: Production of immunity to dengue with virus modified by propagation in mice. *Science* 101: 640-642, June 22, 1945.

OSTEOCHONDRITIS DISSECAN'S OF CARPAL SCAPHOID

REPORT OF A CASE

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and

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Osteochondritis dissecans of the knee joint is not uncommon. Less frequently the elbow, hip and ankle are involved. Occurrence in the wrist joint, however, is rare.

Case report.—The patient, a 21-year-old aviation machinist, was admitted to the hospital on 3 January 1944, complaining of pain and stiffness of the left wrist. He gave a history of awakening one morning 3 weeks previously with a painful left wrist. He could recall no injury, either recent or remote, and no prior similar trouble. Symptoms persisted and he was unable to carry out his duties.

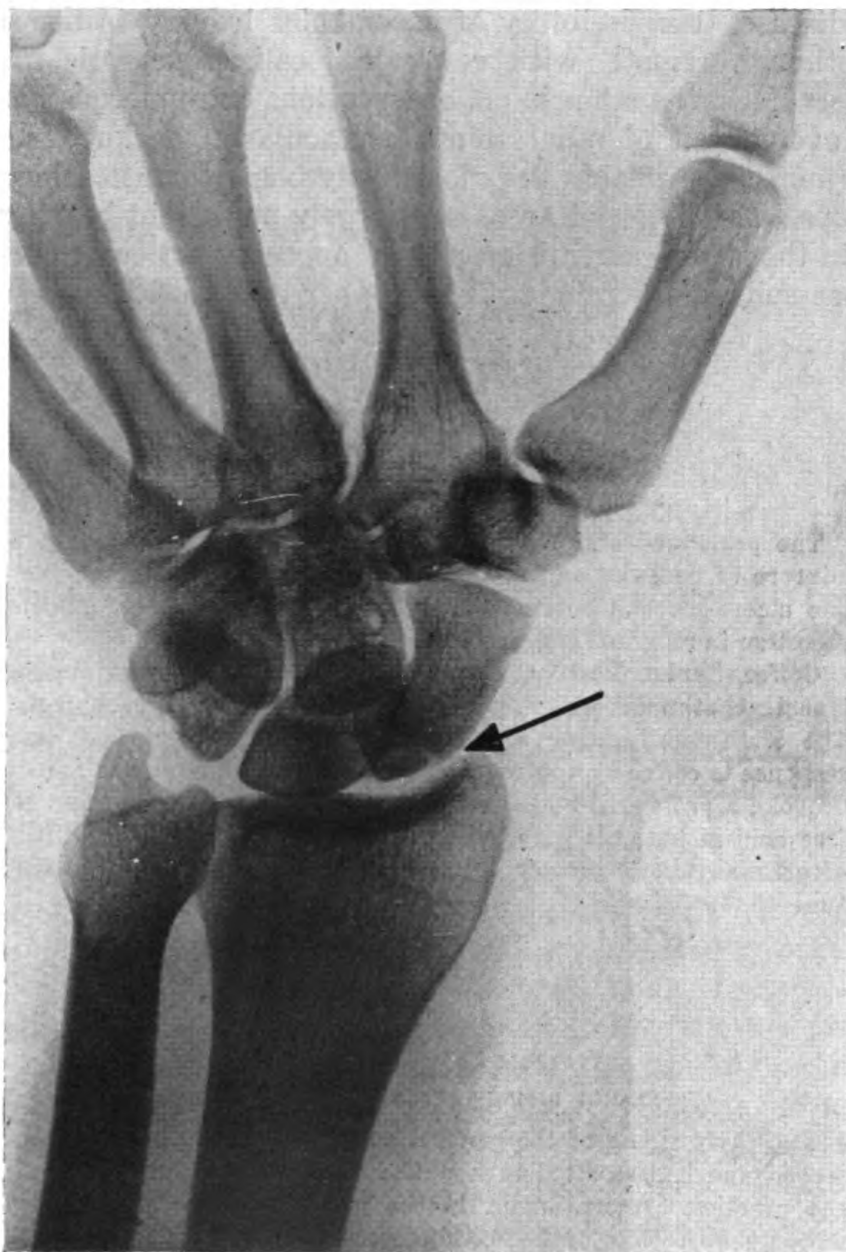
Examination of the left wrist revealed no swelling or deformity, but there was localized tenderness over the carpal scaphoid. All motions of the wrist were moderately limited, and when forced were painful. The left grip was weaker than the right.

The patient also had a history of rheumatic fever with intermittent acute attacks involving a number of joints, and requiring bed rest for from a few days to six weeks, between the ages of nine and nineteen. He could not recall the left wrist being involved in any of the attacks. There was no history of myocardial decompensation.

The blood pressure was 120/80 and the pulse rate 76 and regular. There was no enlargement of the heart, but a definite, late diastolic murmur was heard at the apex. Radiographic examination of the chest, and electrocardiographic, blood, and urine studies revealed no evidence of pathosis. Physical examination did not disclose any other pertinent findings. The impression was mitral stenosis, compensated, rheumatic in origin, and evacuation to the United States for medical survey was recommended.

Roentgenographic study of the left wrist showed an oval circumscribed area of the scaphoid of slightly increased density on the radial articular cortex with a surrounding thin zone of decreased density as shown in the accompanying illustration. Roentgenographs of the right wrist, both elbows, and knees revealed no evidence of bone or joint pathosis.

The patient was evacuated to the United States on 17 January with recommendation for medical survey from the service on a cardiac basis.



Roentgenograph showing an oval-shaped area of slightly increased density surrounded by a zone of decreased density on the proximal articular surface of the scaphoid (arrow).

COMMENT

Although operative verification of the diagnosis in this case was not made, it is thought that the history, physical and roentgenographic findings are adequate to establish the diagnosis. No features in the case indicate the lesion to be a fracture. No definite causative factor can be determined; however with a long history of recurrent acute attacks of rheumatic fever, and with a valvular

heart disease, the possibility of an embolus lodging in the scaphoid, although remote, with resultant localized necrosis may be considered. On the other hand, observations on numerous patients with involvement of other joints, particularly the knee, suggest that trauma is probably the most likely basis for osteochondritis dissecans. The involved areas are largely on weight-bearing surfaces in the lower extremities, and on opposing articular surfaces, or those subject to trauma, in the upper extremities.



EFFECT OF COFFEE UPON THE STOMACH

The prolonged and continuous administration of caffeine in a mixture of beeswax and mineral oil is capable of producing gastric ulcers in cats, but not in dogs. Caffeine stimulates gastric secretion in man and the cat, but not in the dog.

Coffee, Sanka, Postum, Coca-Cola, and tea provoke an abrupt transient stimulation of gastric secretion in normal subjects. The addition of sugar and cream reduces the total free acid response to coffee by approximately 40 percent. Coffee and Sanka provoke a prolonged and sustained increase in the total output of free acid in patients with peptic ulcer.—ROTH, J. L. D'A.: Effect of caffeine upon stomach. *Proc. Inst. Med. Chic.* 15: 350-354, June 15, 1945.



"EARLY RISING" AFTER MAJOR SURGERY

The early rising of the general surgical patients has been observed and has resulted in a uniformly favorable impression of the practice. Improvement in the general well-being of these patients over that of bed-confined patients has been discussed. With early rising there is improved morale, avoidance of asthenia, more patient self-care and less nursing care, less financial loss to the patient because of shorter hospitalization and earlier rehabilitation, and because of more rapid turnover more patients can be cared for with existing hospital facilities and personnel. Early-rising patients have been shown to have a lower postoperative fever of shorter duration than the bed-confined patients of four other general surgical services. This factor is closely related to observed improvement in respiration. The record of complications presented compares favorably with the number of complications observed in a similar group of bed-confined patients.—SCHAFER, P. W., and DRAGSTEDT, L. R.: "Early rising" following major surgical operations. *Surg., Gynec. & Obst.* 81: 93-97, July 1945.

PATHOLOGIC FINDINGS IN A CASE OF AINHUM

COMPARISON OF THE EPIDERMAL AND VASCULAR LESIONS WITH THE NORMAL TOE

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A case of ainhum is being reported for the following reasons: First, since the disease has been recorded as common only among the Negro population of certain areas, medical officers who are unfamiliar with its manifestations may encounter the disease on foreign duty. Second, we have found that certain microscopic changes previously reported as characteristic, in reality occur also in the normal toe.

Ainhum is a disease of undetermined origin which occurs chiefly in Negroes. It is characterized by a fibrous constriction of the little toe at the level of the digitoplantar fold. Rarely other toes and even the fingers may be involved (1) (2) (3). It is generally believed that a band of fibrous tissue encircling the toe progressively constricts the soft tissue so that the underlying middle phalanx undergoes pressure atrophy and resorption. When the latter occurs, the distal segment of the toe is attached to the proximal phalanx only by a strand of soft tissue. Spontaneous amputation may occur, either as the result of gangrene or trauma. However surgical amputation is frequently performed for the relief of pain.

In 1864, da Silva Lima (4) first accurately described cases of the disease in Bahia, Rio de Janeiro, and Buenos Aires. He believed that it occurred exclusively in the Negro, since whites and the aboriginal Brazilian Indians were free of the disease. However a few cases have since been reported in other races. The Nagos tribes of Negroes, who were imported to South America from the West Coast of Africa, were familiar with the disease which they called "ainhum." This term was adopted by da Silva Lima. Since that time cases have been reported from British Guiana (5), St. Thomas (6), Trinidad (7), Jamaica (8), St. Croix

(9), the Canal Zone (10), British Honduras (11), Costa Rica (12), Madagascar (4), the West Coast of Africa (13), Pretoria (14), Egypt (15), Mozambique (16), Dacca (2), and the United States (17) (18) (19) (20) (21) (22) (23). The disease is, therefore, geographically widespread in tropic and subtropic countries.

Since 1864 over 200 papers on the subject of ainhum have been published. Forty-five cases have been reported in the United States up to 1944 (20) (24). Undoubtedly, however, many cases recognized clinically have not been reported. Consequently, although the disease is rare in temperate climates, it is probably not unusual in the tropics. The most recent and comprehensive review of the literature was made by Spinzig (24).

Many theories have been advanced, none of which offers a satisfactory explanation of the cause of ainhum or why it is so commonly limited to the little toe. Leprosy, syphilis, epidermophytosis, chronic irritation, injury, and the great obliquity of the flexor tendons of the last two toes in Negroes have been offered as possible causative factors. It has also been suggested that the cause may be self mutilation by ligatures or rings, but in many cases self injury cannot be demonstrated. However since the microscopic changes in the affected toe are not characteristic of any of these diseases, the cause of ainhum is still undetermined and it is probable that a number of factors, singly or in combination, may cause the lesions.

There is, however, general agreement on the pathologic findings (1) (4) (23) (25) (26) (27) in the amputated toes. Microscopically the epidermis is hyperkeratotic. Beneath the skin are various amounts of chronic inflammatory exudate. The constricting fibrous band is either dense hyaline scar, or granulation tissue showing foreign-body reaction. In most cases, however, bacteria or fungi have not been demonstrated in these lesions. The media of the small arteries is said to be conspicuously hypertrophied and the intima of these vessels may be thickened. The bony phalanx shows different degrees of atrophy, resorption and replacement by fibrous tissue. Regeneration or infiltration of the bone by inflammatory exudate has not been reported as characteristic of the disease.

Case report.—A male Negro veteran, 50 years of age, was admitted to the U. S. Naval Hospital, Philadelphia, Pa., on 10 July 1944, complaining of pain in the right little toe. These symptoms began 4 years previously when he accidentally lacerated the toe while attempting to remove a corn with a knife. This lesion did not heal and the toe continued to be painful to the time of the present admission. He had no other symptoms and nothing of significance was elicited in the past medical or family histories. He was born in Georgia where he had lived until about 1934 when he moved to a northern area.

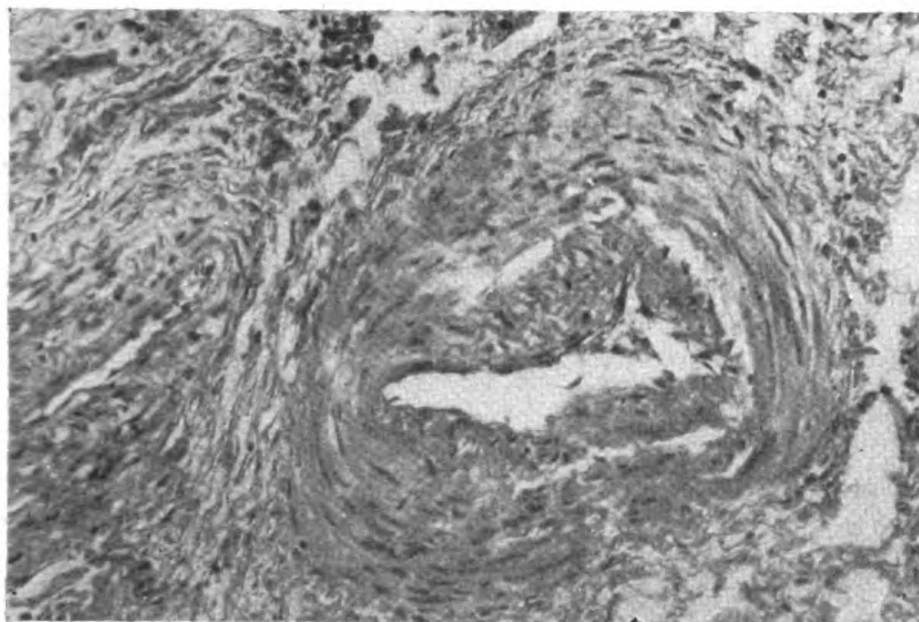
On examination there was found an encircling band of fibrous tissue constricting the right little toe at the level of the distal interphalangeal joint. On the plantar surface of this joint there was a deep circular indolent ulcer, 1 cm. in diameter. The soft tissue at the distal end of the toe was bulbous but not inflamed. The nail was atrophic. The left little toe was also constricted to a lesser degree in the same area but was not ulcerated or tender. The posterior tibial and dorsalis pedis pulsations were readily palpable in both feet. The other findings of physical examination were essentially normal.

On 29 July the right little toe was amputated through the head of the fifth metatarsal bone, and longitudinal incisions were made through the constricting band of the left little toe. The wound healed promptly and the patient was discharged asymptomatic on 10 August.

Important laboratory data included roentgenograms of the feet, which showed considerable narrowing and partial destruction of the distal and middle phalanges of both little toes, more extreme on the right foot. The blood Kahn test was weakly positive. Other laboratory data were within normal limits.

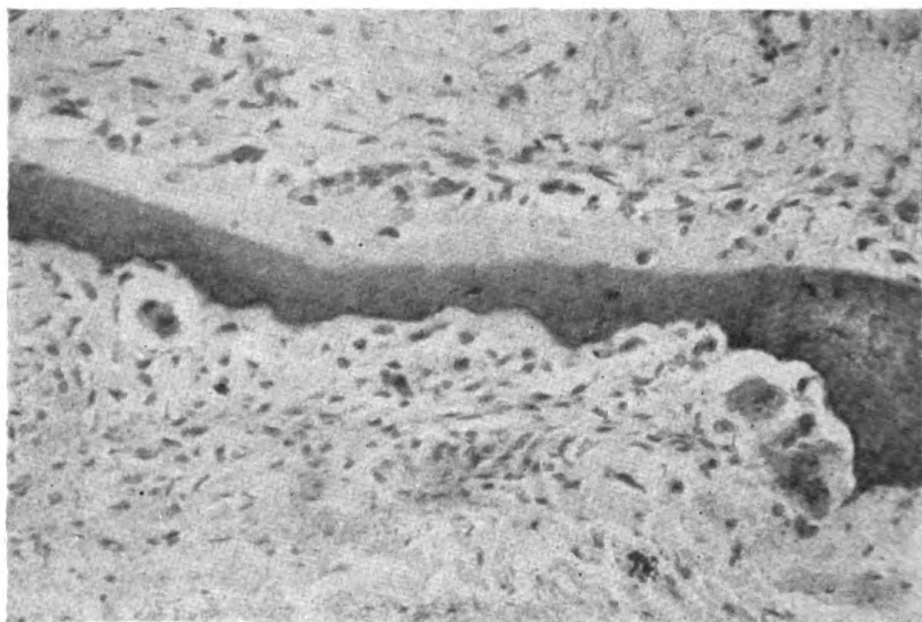
On microscopic examination of the toe, the stratified squamous epithelium of the skin showed moderate hyperkeratosis and acanthosis. The rete cones were elongated. Beneath the epithelium there were focal collections of lymphocytes and plasma cells which were most numerous in the vicinity of capillaries and arterioles. Although most of the small blood vessels were normal, some of the small arteries had thick media with or without slight fibrous proliferation of the intima and adventitia (fig. 1).

In the deep layer of the subcutaneous tissue at the point of fibrous constriction, there were patternless interlacing bundles and sheaths of relatively acellular fibrous tissue which were not accompanied by any inflammatory reaction. At the point of maximum constriction, the shaft of the bone had disappeared, but a few spicules of bone were being resorbed by osteoclasts (fig. 2). Fragments of degenerating articular cartilage extended almost to



1. The media of the artery appears to be hypertrophied. There is proliferation of the intima.

the epidermis. Lateral to the point of constriction, the shafts of the phalanges showed beginning subperiosteal new bone formation, but the bony trabeculae and marrow spaces of the medulla were not remarkable.



2. About the periphery of the necrotic spicule of bone are osteoclasts and proliferating fibrous tissue.

COMMENT

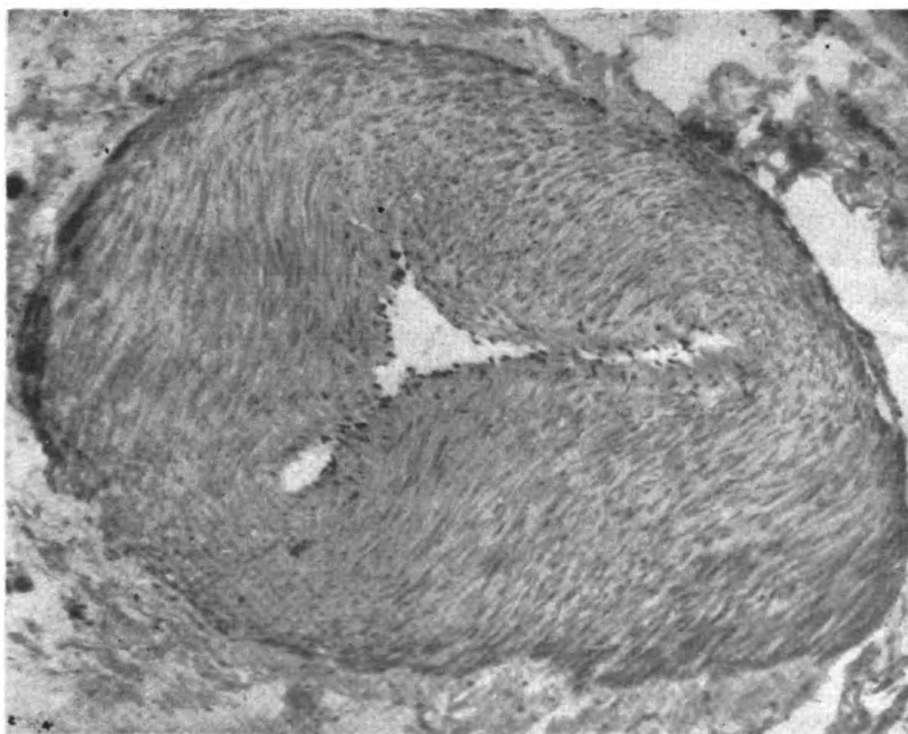
In the present case, the hyperkeratinization of the epithelium, subcuticular round cell infiltration, scarring, hypertrophy of the muscularis of the smaller arteries, and necrosis and resorption of the middle phalanx correspond to the changes which have been previously described in the disease; but the additional findings of chronic osteomyelitis, characterized by sequestration, foreign-body reaction, and new bone formation, have not been stressed in the literature as an important feature of the disease. Furthermore the roentgenographic appearance of the left toe was similar, but less marked, than that of the right. It is likely, therefore, that the microscopic findings in both toes would be similar.

At first glance, the hyperkeratinization of the epidermis and the thickening of the media of the small arteries appear to be abnormal, but we have been unable to find in the literature a comparison of the toes of normal persons with cases of ainhum, to substantiate this supposed abnormality. Accordingly microscopic sections were prepared of the little toes of 4 white servicemen less than 30 years of age who died as the result of traumatic injuries. These toes were all grossly normal. In one case the

keratinization of the plantar epithelium was just as great as in the present case of ainhum. In a second case small arteries were found in which the thickness of the media was even greater than in the present case (fig. 3). However there was no proliferation of the intima.

In the remaining cases the small arteries and arterioles did not show such thickening of the media and would be considered normal by comparison with the vessels of similar size elsewhere in the body. In none of these cases was there any evidence of inflammation of the soft tissues, or of bony abnormalities. It may be concluded, therefore, that the degree of keratinization and medial hypertrophy of the small arteries which have been described in ainhum are not a characteristic of the disease, but are a variation of the normal toe. The intimal proliferation seen in cases of ainhum, furthermore, is no greater than commonly occurs with inflammatory lesions elsewhere in the body and is not to be considered in any way specific.

The essential lesion in this case, consequently, is a bilateral chronic osteomyelitis. It is probable that following necrosis and sequestration of the phalanx, organization of inflammatory exudate resulted in cicatrization of the soft tissues. The fibrous con-



3. The artery in a normal foot appears to have a hypertrophied media. This is due to contraction of the vessel and to a normal variation in thickness of the media. There is no proliferation of the intima.

striction of the toes was not, therefore, the cause but the result of the disease.

The cause of the osteomyelitis is, however, in doubt. Trauma and infection at an earlier date are suggested by the history. Circulatory disturbance in the extremities does not appear to be a factor, since, so far as could be demonstrated clinically and microscopically, the blood supply to the feet and toes was adequate. Although the blood Kahn test was weakly positive, the inflammatory changes in the bone and soft tissues were not specific for syphilis.

Although cases of ainhum have been recognized among Negroes in widely scattered areas of the tropics, so far as we can learn cases have not been reported in the South and Central Pacific islands. There is every reason to suppose that it should occur among the Melanesian and Polynesian populations. In these localities the suggested etiologic factors of trauma and secondary infection incident to going barefoot, to yaws, leprosy, etc., are more prevalent than in temperate climates.

SUMMARY

1. A case of ainhum is reported in which the essential lesion appears to be chronic osteomyelitis.
2. It is suggested that the fibrous constriction of the little toe is not the cause of bone destruction but is the result of cicatrization of previously inflamed tissue.
3. The hyperkeratinization and the hypertrophy of the media of small arteries are not characteristic of the disease but can be demonstrated in the normal toe.
4. The disease has not been reported in the tropical Pacific, but its occurrence in that area is likely.

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SIMULATING SERUM-SICKNESS REACTION TO PENICILLIN

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One of the important features of penicillin is its low toxicity. Urticaria, however, apparently is a frequent reaction. Keefer et al.,¹ in treating 500 cases with penicillin, noted the following toxic reactions:

Fever	5 cases
Chills and fever.....	12 cases
Thrombophlebitis at site of injection....	19 cases
Urticaria	14 cases
Gluteal tenderness at site of injection...	5 cases
Headache, flushing of face.....	10 cases
Tingling in testes.....	2 cases
Pains in muscles.....	2 cases

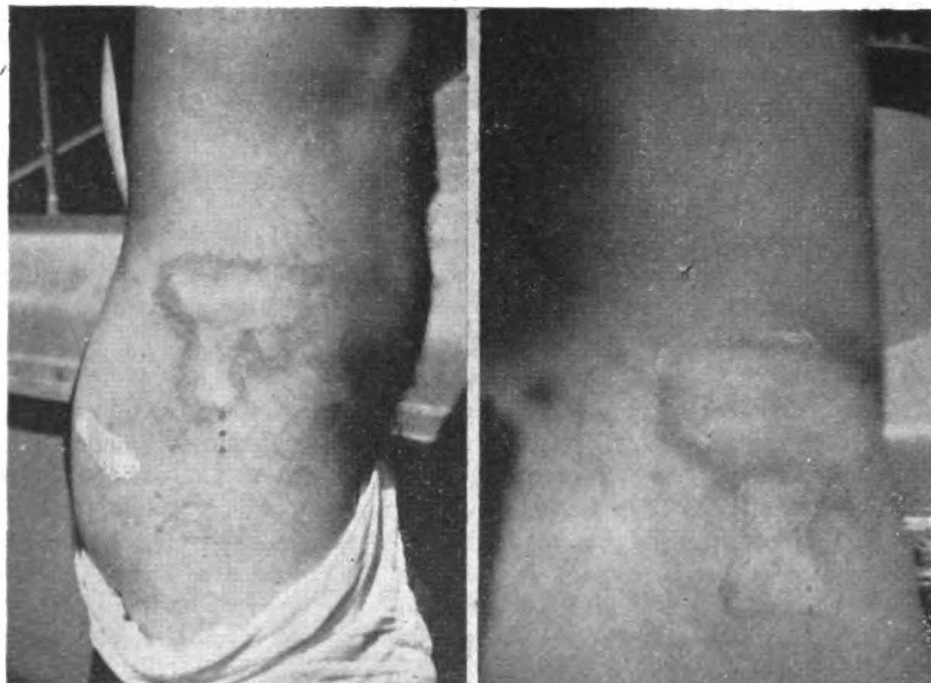
It was pointed out by these investigators that there is the probability that at least some of the reactions were caused by impurities in the preparation rather than by the penicillin itself. The following case illustrates the difficulty involved in determining the agent responsible for an allergic reaction to the therapeutic use of the drug.

Case report.—A 21-year-old white seaman reported to the sickbay on 16 October 1944, complaining of a purulent urethral discharge and dysuria of one day's duration, and giving a history of sexual exposure 6 days previously. A smear of the urethral discharge showed many intracellular, gram-negative diplococci; a diagnosis of gonorrheal urethritis was made. The man was treated for 3 days with sulfathiazole without improvement.

On 20 October 1944, penicillin treatment was started, a total of 100,000 Oxford units of calcium penicillin being given in 5 intramuscular injections at three-hour intervals. The next day the patient was symptom free, and on 22 October a prostatic smear was negative.

On 11 November the patient had a recurrence of dysuria and a small amount of a clear urethral discharge, which on microscopic examination showed no gram-negative, intracellular diplococci. On 12 November the

¹ KEEFER, C. S.; BLAKE, F. G.; MARSHALL, E. K., JR.; LOCKWOOD, J. S.; and WOOD, W. B., JR.: Penicillin in treatment of infections; report of 500 cases; statement by Committee on Chemotherapeutic and other Agents, Division of Medical Sciences, National Research Council. J.A.M.A. 122: 1217-1224, August 28, 1943.



1. Showing a large area of urticaria just above the right hip.

dysuria continued, and a second course of 100,000 Oxford units of calcium penicillin was given. There had been a period of 23 days between the 2 courses of penicillin.

The dysuria disappeared the following day, and the patient was well for 6 days. On 18 November, 6 days following the second course of penicillin, the patient developed large urticarial welts on the abdomen, back, and over the hips (fig. 1). During the day he also developed arthralgia of the wrists and ankles, moderate edema of the feet and hands, a temperature of 99° F., headache, and a moderate generalized lymphadenopathy. A trace of albumin was found in the urine.

The findings remained unchanged for a period of 3 days, except for a gradual spread of the urticaria to the extremities (fig. 2), face, and scalp.



2. Showing an urticarial wheal on the forearm, with an erythematous margin.

The areas of urticaria measured from 2 cm. in diameter up to 15 cm. in diameter. The temperature reached a maximum of 99.6° Fahrenheit. At no time was the spleen palpable. The symptoms began to subside after the third day, but some areas of urticaria persisted for a period of 6 days. The urine was negative for albumin after the third day.

Treatment consisted in the local application of calamine lotion to the areas of urticaria and an occasional intramuscular injection of 0.5 cc. of 1:1,000 epinephrine solution. The epinephrine produced relief of the itching and an almost complete disappearance of the urticaria for a period of about 3 hours. Ephedrine, $\frac{3}{8}$ grain subcutaneously, and benzedrine sulfate by mouth were given with very little effect on the symptoms.

Penicillin skin tests: One week following the disappearance of the symptoms, intradermal tests were made on the forearm of the patient and on 3 controls with 0.1 cc. of a 1:10 solution and a 1:100 solution of calcium penicillin in normal saline. The 3 controls showed no reaction. The patient showed no reaction at the sites of injection; but beginning 5 hours after the injections were given, multiple small areas of urticaria measuring from 0.3 to 1 cm. in diameter appeared on the skin of the upper arm above the sites of the skin tests. No urticaria occurred on other parts of the body, the reaction being limited to the arm on which the skin tests had been made. This reaction was mild and disappeared after about 3 hours.

COMMENT

Urticarial reactions to penicillin have been described by Lyons² as occurring in 12 out of 209 penicillin-treated cases in Army hospitals. Rosenberg and Arling³ have reported 71 cases of meningitis treated with penicillin, of which 3 cases showed a transitory urticaria within 24 hours after therapy was started. No other local or toxic effects were noted.

Criep⁴ has recently reported a case in which the patient showed an urticarial reaction to penicillin, resembling the one reported in this paper, in that a massive generalized urticaria developed during a second course of penicillin. There had been a 10-day interval between the two courses.

The case reported in the present paper was striking in its similarity to serum sickness. The urticaria was accompanied by generalized symptoms and did not appear until after an interval of 6 days following a second course of penicillin treatment. The results of the skin tests with calcium penicillin solutions indicate a definite sensitivity of the patient to some substance in the solution. It was not determined whether the reaction was due to penicillin or to an impurity in the preparation.

² LYONS, C.: Penicillin therapy of surgical infections in the U. S. Army. J.A.M.A. 123: 1017-1018, December 18, 1943.

³ ROSENBERG, D. H., and ARLING, P. A.: Penicillin in treatment of meningitis. J.A.M.A. 125: 1011-1017, August 12, 1944.

⁴ CRIEP, L. H.: Allergy to penicillin. J.A.M.A. 126: 429-430, October 14, 1944.

ADVANCEMENT OF SUPERIOR OBLIQUE MUSCLE FOR CORRECTION OF DIPLOPIA

REPORT OF A CASE

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Before the work of Wheeler in 1935, operation on the superior oblique muscle involving shortening of this muscle was considered an impossibility. Banister stated, "Owing to the anatomical relations of the superior and inferior oblique muscles to the eyeball, their deep location in the orbit and their attachments to the globe in the neighborhood of the equator, any special procedure of a surgical character directed to the paralyzed oblique muscles themselves, in the nature of an advancement or shortening by tucking, is out of the question. In attempting to relieve the distressing diplopia in such instances of paralysis, the ophthalmic surgeon must make use of the other muscles, the recti."

Wheeler¹ reported five cases in which he had advanced the paralyzed superior oblique muscle with good results. His technic comprises operating on the muscle after complete tenotomy of the rectus superior, with retraction of this muscle upward on double-arm sutures. The superior oblique muscle is isolated on a muscle hook and a double-arm suture is looped through the middle third of the tendon several millimeters from the scleral insertion. The needles are carried laterally in advance of the original insertion and inserted through the sclera at a distance varying with the amount of slack in the muscle and the amount of correction desired. The eyeball is rotated downward and inward during this maneuver. The tendon is not cut from the original insertion. Following this the superior rectus is resutured to the muscle stump in its original position.

In the following case of hyperphoria of high degree the superior oblique tendon was shortened by Wheeler's method with a good result.

¹ WHEELER, J. M.: Advancement of superior oblique and inferior oblique ocular muscles. *Am. J. Ophth.* 18: 1-5, January 1935.

Case report.—A 39-year-old Marine private reported to the dispensary on 23 May 1944, with the complaint of double vision of 16 years' duration. There was no family history of eye trouble. The only incident in the patient's past medical history that could be related to the eye findings was an accident, which occurred shortly before the onset of symptoms, in which his nose had been broken. For about 16 years his eyes had given him a great deal of trouble. Blurring and double vision were the main complaints. The images were usually separated vertically and varied with the position of the head. His eyeglasses had been changed many times with some relief when he carried his head tilted to the right. In recent months he had found it increasingly difficult to do his work because of this annoying diplopia.

The vision was 20/20 in both eyes with or without glasses. The patient had a decided head tilt to the right side. He was wearing a 4-prism diopter lens, base up, on the right eye and a 5-prism diopter lens, base down, on the left eye. Ocular rotations showed a limitation of motion of the left eye on looking down and to the right. On looking to the right and up there appeared to be a slight overaction of the left inferior oblique muscle. In the primary position there were 20-prism diopters of left hyperphoria. This increased to approximately 23-prism diopters of left hyperphoria when the patient looked down and to the right. It decreased to 8-prism diopters on his looking up or down and to the left.

These figures varied from day to day, but in general the patient required 20-prism diopters' correction of the diplopia in the primary position. There was an esophoria of 12-prism diopters. Diplopia tests therefore indicated a paresis of the left superior oblique with slight overaction of the left inferior oblique muscle. Refractive error, with the exception of the prism correction, was negligible.

On 26 June, a shortening of the superior oblique tendon was done by Wheeler's method. On exposure the tendon was seen to have a good deal of slack at its insertion. Double-arm sutures of fine black silk were placed in the tendon one centimeter from its insertion and were then fixed to the sclera one centimeter in advance of the original insertion. This took up the slack in the tendon and placed it under moderate tension. The superior rectus tendon was resutured in its original position.

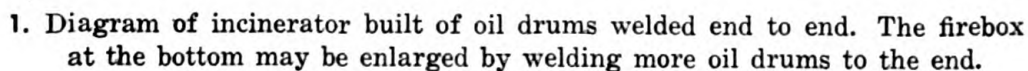
Three days following the operation the swelling of the conjunctiva had subsided and the hyperphoria was found to vary from none to 3 diopters (left hyperphoria) in the primary position. There was excellent rotation of the left eye downward and to the right side. Twelve days after operation between 3- and 4-prism diopters of left hyperphoria and 8 diopters of esophoria remained. The patient was having slight diplopia in the form of obliquity of images, apparently due to a slight cyclophoria in a direction opposite to the original cyclophoria. He was wearing no eyeglasses.

A few days later all diplopia in the primary position had disappeared, the head tilt had improved, and the patient was comfortable. At this time he was transferred to another activity, and a checkup there on 23 August showed esophoria of 2-prism diopters, left hyperphoria of 0.4 diopters, and prism divergence of 6 diopters. The patient had no complaints and the eyes were comfortable.

It is believed that in any paresis of the superior oblique associated with a large amount of hyperphoria, this operation is preferable to one which weakens or recesses the opposite inferior rectus.

PORTABLE GARBAGE INCINERATORS FROM SCRAP MATERIALS IN THE FIELD

The most satisfactory method of disposing of garbage after landing on an enemy shore is to dump it in the ocean when wind and currents are favorable, a situation not always existent. The next most satisfactory method is complete incineration, but the difficulties of making an efficient incinerator are numerous, particularly when fire brick is not available.



Using only scrap materials, two types of incinerator, both constructed on the same general plan, were devised and operated. One is made of available empty oil drums, and the other of Japanese airfield mats and light railroad rails. Both have the advantage of doing an efficient job of incineration and of being portable. Both have the disadvantage that, being of metal, they burn out rather rapidly. However it is not difficult to replace them, especially if the services of Seabees are available. The incinerators are very satisfactory for the critical first weeks or months of a unit ashore, by which time a system of garbage disposal on a large scale will probably have been set up.

Both incinerators operate on the principle of dehydrating the garbage before it is burned. The incinerator fits on a hillside. A fire burns the garbage at the bottom, and the smoke and flames from the fire are carried upward both above and below a steel plate on which is placed the garbage to be burned. The intense



2. Oil drum incinerator from below, showing double firebox. Fuel burning in lower part of firebox consumes garbage in upper part. Section of oil drum between two parts is perforated.



3. Oil drum incinerator, view from above, showing garbage loaded on platform heated by flame from below.

heat around the plate dehydrates and partly burns the garbage before it gets to the main firebox.

Figure 1 is a diagram of an oil drum incinerator, in its simplest form. The method of construction by welding oil drums end to end can be plainly seen in figure 2, as well as the principle of loading the garbage on the hot platform at the top, and of pushing it down a hotter metal slide inside the oil drums to the fire below. This platform and slide is also made of oil drums, unrolled and flattened by driving a truck over them. The double-layer firebox below can be seen (fig. 3).

The section of oil drum between the two parts is perforated to form a grate. Fuel is burned in the bottom part, consuming the garbage in the part above. Wood, oil, gasoline, or oil-soaked coconuts may be used as fuel. The capacity of the double-layer firebox may be increased by welding other oil drums on the end.

An incinerator made of Japanese airfield matting on almost

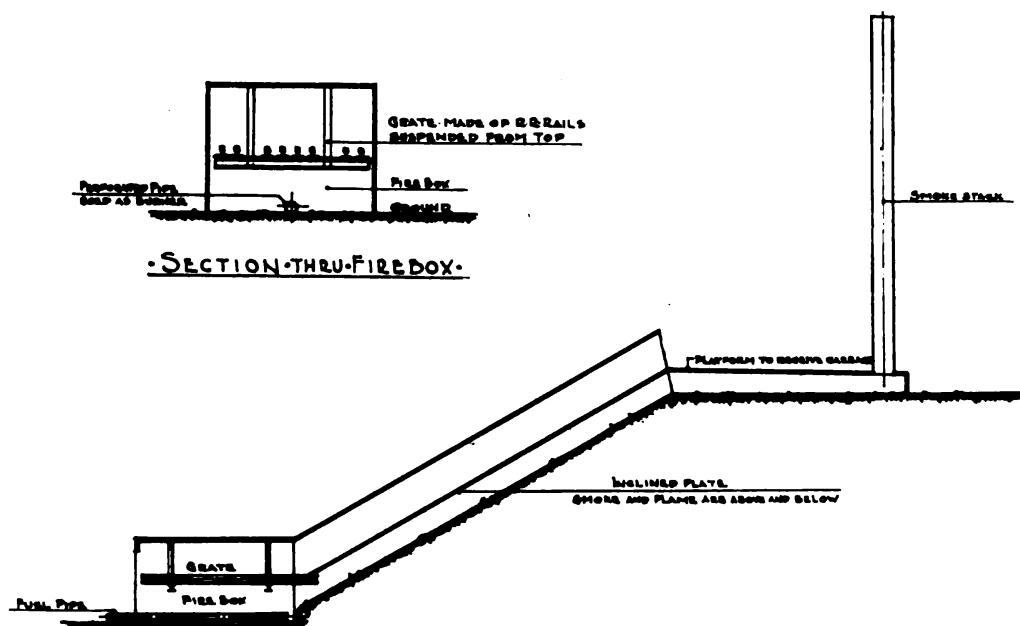


4. Incinerator made of Japanese airfield mats, on same principle as oil drum incinerator. In improved form, the firebox was turned in order to be in line with the chute. Illustration shows small pipe for gasoline burner, but larger pipe was found superior.

exactly the same principle as the oil drum incinerator, but heavier and more durable, is shown in figure 4. The latest and improved form of this incinerator, the improvements being based on practical experience, is illustrated in the accompanying diagram (fig. 5). The firebox is in line with the chute instead of at right angles to it, because the flames had a tendency to burn out the metal at the corners. The grate is made of light railroad rails, and these are suspended from above in order to obviate the effect of expansion and contraction, and to keep the supports of the grate away from the flames.

It was found unnecessary to build the incinerator completely of metal so the bottom was left exposed throughout to the bare earth. Captured 90-octane Japanese gasoline which was unsatisfactory for American engines, was used as fuel. It burned with a very hot flame from a burner made from a length of perforated iron pipe.

One or more oil drum incinerators can be constructed at a base and carried on shipboard, ready to use on landing. One incinerator can conveniently handle the garbage for an outfit of over 1,000 men. The oil drum incinerator burns out after a week of continuous use, but a construction battalion can make a new one with-



5. Diagram of incinerator made of Japanese airfield mats.

out difficulty. The airfield mat incinerator is more sturdy. With repairs and improvements the model described was still in use after 2 months, when an island-wide garbage disposal system, using barges was instituted.

ACKNOWLEDGMENTS.—Many of the ideas and all of the technical skill in building and improving these incinerators were supplied by the following men of the 72d Naval Construction Battalion: J. L. Rogers, Chief Shipfitter; B. H. Connelly, Chief Shipfitter; H. H. Brady, Chief Shipfitter; A. Rosenfeld, Boatswain's Mate, first class; and J. J. Kidner, Seaman, first class, all of the Naval Reserve.



HEPATITIS FROM MUMPS CONVALESCENT SERUM

An attempt was made to control an epidemic of mumps in a training regiment by passive immunization of susceptibles. Two lots of plasma were prepared from convalescents. The first lot was given to 266 men and the second to 204 of these same men 16 days later. The epidemic was not immediately cut short but declined rapidly. Its decline may have been due to causes other than passive immunization. Cases occurred in inoculated men in the period when they should have been protected, and attack rates on the inoculated men and a control group were not significantly different.—BEESON, P. B.; CHESNEY, G.; and MCFARLAN, A. M.: Hepatitis following injection of mumps convalescent plasma. *Lancet* 1: 814-815, June 24, 1945.



NATURE OF THE RH FACTOR

The Rh factor is a true agglutinin and appears to be in the form of a carbohydrate attached to proteins of the erythrocyte. It is slow acting and produces its effect best at body temperature. The introduction of Rh positive blood stimulates the formation of anti-Rh agglutinins in the recipient. This sensitization is believed to take about five days to develop. If such a person is subsequently transfused with Rh positive blood, agglutination and a disastrous hemolytic reaction are to be expected.

There is evidence that sensitivity to the Rh factor, once it is acquired, may persist for many years, probably for life. This sensitivity appears to be a true tissue immunization which persists even after the antibodies can no longer be detected. It is obvious, therefore, that Rh incompatibility is a grave danger which must be well understood by every one having anything to do with the transfusion of whole blood or blood cells.—GOULD, G. A.: Transfusion survey. Roy. Canad. Nav. M. J. 9: 2-11, June 1945.



MODIFIED METHYLENE BLUE TEST IN HEPATITIS

The modified methylene blue test is as follows: To 5 cc. of a pre-breakfast urine specimen were added 2 drops of an 0.2-percent aqueous solution of methylene blue chloride. If a green color resulted, more methylene blue was added dropwise and the last drop required to convert the green color to blue was recorded. Pipets were used which delivered 20 drops of the solution per cubic centimeter. Methylene blue chloride proved to be satisfactory in that the dye content of different lots showed little variation. When readings were made by natural light, no difficulty was found in determining the change from a green color to blue. If more than 5 drops were required to produce the color change, the urine was diluted with distilled water and methylene blue was added again drop by drop until the end point was reached. Correction was then made for the dilution factor. This was found to be necessary because the addition of more than 5 drops of methylene blue resulted in a color of such intensity that the end point was difficult to determine.—GELLIS, S. S., and STOKES, J., JR.: Methylene blue test in infectious (epidemic) hepatitis. J.A.M.A. 128: 782-783, July 14, 1945.

IMPROVISED SURGICAL FACILITIES FOR SMALL VESSELS

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It was strikingly brought home to this writer on the occasion of being faced with the performance of an appendectomy on an LST several days out of the nearest port, that the drapes, towels, and routine which so magically appear in a hospital operating room are matters all too largely taken for granted without the knowledge of how they come about. The proper folding of a laparotomy sheet, for example, required a good many attempts before it was satisfactorily done. Sterilization of linens and dressings appears to presuppose the existence of an autoclave, a device, unfortunately not present on LSTs and smaller craft. Occasionally a pressure cooker of the large cast iron type may be found in the galley of an LST. It will serve as an autoclave with certain precautions. In many instances, the pressure requirements of 15 pounds per square inch cannot be attained by these cookers. In this event some chemical indicator of the "Steam-Clox" type is needed.

The minimum requirements for sterilization are set forth as 15 pounds pressure and a temperature of 245° Fahrenheit. The time required for sterilization of various materials at this temperature and pressure is: (1) For linens, dressings, and packs, 1 hour; (2) for instruments and other nonporous, smooth surfaced articles, 30 minutes; (3) for clean and well-powdered rubber goods, 15 minutes. The interval is measured from the time that the temperature and pressure have attained the required degree. If these cannot be obtained, reliance must be placed on the chemical indicators, and the time requirements determined by trial and error for linens and for the other materials.

With the use of an improvised autoclave, an objection will be found in that goods may come from the sterilizer quite wet. To avoid this difficulty, after the required time has elapsed the steam should be shut off and the pressure allowed to fall to a level which will permit a crack opening of the door of the chamber. This allows a current of air to flow by convection through the lower part of the crack, through the chamber, and out through the top

of the opening in the door. The residual heat of the chamber and goods will cause drying in about a half hour so that goods may be removed and aired. Frequent turning of the pack is recommended to allow the final traces of moisture to escape.

In the absence of some steam pressure appliance, reliance must be placed on dry heat as provided by the galley oven. A temperature of at least 320° F. is required in all cases. Time requirements for sterilization of the following are: (1) For petrolatum gauze and talc in bulk, 2 hours, (these materials must be sterilized in this manner in any event, because steam will not penetrate them adequately and the temperature of an autoclave is not sufficient); (2) linens and packs, 1 hour; (3) instruments, 30 minutes; (4) rubber goods, clean and well powdered, 15 minutes.

It will probably be preferable to boil instruments and glassware rather than to use the autoclave or the oven. A clean dishpan will suffice. Instruments must be thoroughly scrubbed with soap and a brush, particular attention being paid to the jaws and locks so that all dried blood and rust are removed, and that no oil remains on the instruments. A sterile forceps must be at hand for the removal of the instruments. After 30-minutes' boiling the articles are removed and allowed to drain and dry before placing them on a draped surface in an operative set-up, since any wetting of the drapes will expose to contamination from the table top. Nail brushes should be washed and boiled for 30 minutes.

It would be far wiser to make drapes and towel packs where adequate facilities for sterilization are available, such as are found in hospitals and large ships. Packs must be stored in a dry place, which is kept warmer than room temperature to prevent mold formation, especially in tropical areas. Goods must be re-sterilized at least every 30 days.

Tap water when boiled and considered sterile, still contains pyrogens and is unsuitable for parenteral use. Thirty-minutes' boiling is sufficient to assure sterilization. Several cases of saline solution flasks for intravenous use will provide fluid for irrigating wounds or for washing in the absence of sterile, pyrogen-free water. The tubing from a plasma set may be used for this purpose.

An ointment jar of the opal 1-pound size may be used for a suture jar. Ninety-five percent alcohol or a 1:1,000 solution of zephiran will suffice for the fluid. For suture trays, instruments may be kept in zephiran 1:1,000 solution with 1-percent sodium nitrate added in order to prevent rusting. If suture jars are not practical, the tube may be broken and the suture shaken out onto a sterile field.

A sterile "circular table" may be made from a desk or a wide board lashed to two chairs.

A Levine tube and some idea of how to rig an improvised Wangensteen apparatus is necessary. Gallon jugs of the cola syrup type will do well for this purpose. A colon tube will often give the patient relief from gas distress and a bedpan and urinal are necessary items for bed care.

A large syringe and a catheter will provide suction in emergency for abdominal cases. It will prove slow but is better than nothing.

Spinal needles and 50-percent dextrose for intravenous use are required for the temporary treatment of intracranial accidents.

Some foresight must be shown in the procurement of drugs and linens before commissioning. Commissioning outfits for landing-craft medical officers are adequate for emergency work, with the exception of such things as antiseptics, green soap, alcohol, gauze sponges, basins, and catgut sutures.

It should be remembered that a 150-mg. ampule of procaine hydrochloride crystals, such as used for spinal anesthesia, when mixed with a 10-cc. ampule of distilled water makes a 1.5-percent solution for local anesthesia.

Since accidents and other emergencies do not always occur on the ship carrying the medical officer, a water-tight chest with the material needed for an operative set-up should be assembled against those times when he must transfer to another ship. An LCVP is not the driest sort of conveyance in a seaway.

The wardroom on smaller vessels is the traditional place for emergency surgery, and light fixtures are usually put there with that end in view. The tables found in LST wardrooms are of a convenient width, though somewhat low. Positioning of the patient may be done by putting several boards or a plywood sheet under a thin mattress and placing objects under the boards as desired.

For the operating room preparations, the overhead and fixtures should be dusted, a gauze filter placed over the ventilator, and the deck should be dried before use. The sterile table should be conveniently arranged and covered, and when other preparations are complete, the patient is brought into the room.

The hospital corpsmen may possibly have had no operating room experience and all concerned will benefit by going through a dummy operation several times. It is the obligation of the surgeon to make the men understand what is wanted and to show them procedures. With the care and ingenuity of the degree expected of a Naval officer, conditions can be made to approximate those of a hospital operating room to a surprising extent, if the absence of cadmium-plated furniture and plate glass is overlooked.

For anesthesia a spinal will be found infinitely preferable for work below the umbilicus, and the fact that it can be administered by the operator is a point overwhelmingly in its favor. Procaine hydrochloride is the only acceptable drug from a safety standpoint. The operator must provide some vasopressor medication to prevent the patient's blood pressure from falling, causing the nausea associated with spinal anesthetics and a responsible person must be designated to keep a check on the blood pressure and administer the vasopressor when necessary. Neosynephrine 1-percent in the 5-cc. rubber-topped vial for parenteral use will be most convenient and is administered in 0.5-cc. doses.

If spinal anesthetic is not suitable, sodium pentothal in a 2.5-percent solution will probably be next best. Not having oxygen at hand, the most extreme care must be taken to insure adequate respiratory exchange, and an airway must be kept ready for instant use. The medical officer would probably better accomplish the induction, then scrub and perform the operation, giving directions to the corpsman delegated to continue the anesthetic.

The transfer of a patient to and from the wardroom on most small vessels is not easily done, and transfer down to the crew's quarters is impossible. A stateroom on the same deck should be used as a sick room and movement of the patient accomplished with a flexible canvas litter.

It is again emphasized that knowledge of the preparation, folding and packing, and sterilization of drapes and dressings should be gained before the need arises. This applies to both medical officers and corpsmen.

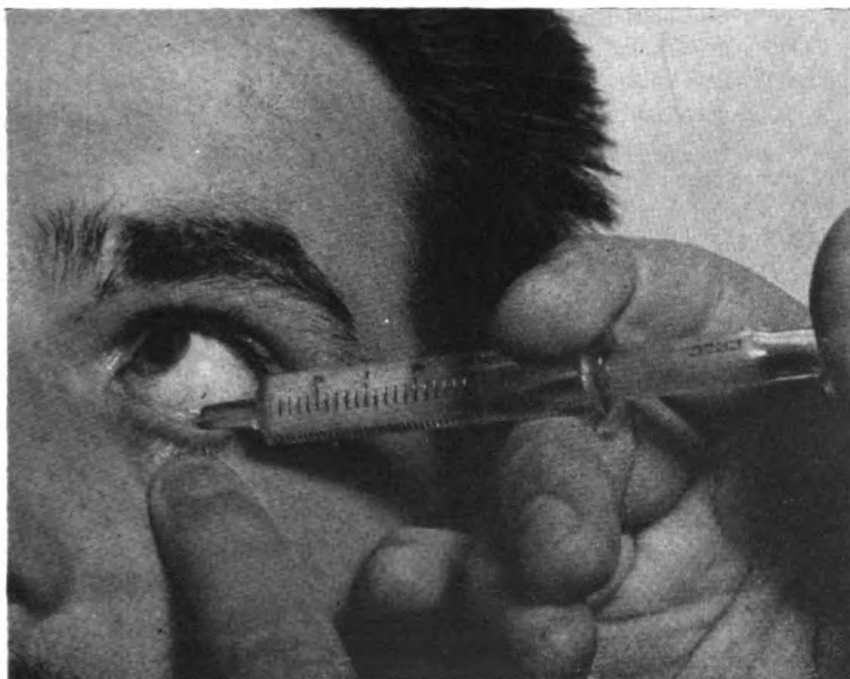
The day of "kitchen-table surgery" is fast disappearing but the need for it will always be present on small vessels of the Navy. Under these circumstances the resourcefulness of the medical officer and corpsmen must substitute for chromium plating and modern appliances.

PRACTICAL METHOD FOR APPLICATION OF OPHTHALMIC OINTMENTS

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To facilitate insertion of eye ointments directly into the lower fornix, when the specially devised collapsible eye-ointment tubes are not available, a 2-cc. ordinary glass syringe is employed. The plunger is withdrawn from the barrel of the syringe and from one-half to two-thirds of the barrel is filled with an ointment by means of a narrow spatula. The plunger is then replaced and the syringe is ready for use.



Slow steady pressure on the plunger causes the issuing of a heavy thread of the ointment from the open tip of the syringe. By pulling down the lower lid, the inferior conjunctival fornix is exposed and a $\frac{3}{4}$ -inch thread of ointment may easily be laid into the conjunctival sac. The amount of ointment instilled can be controlled under direct vision. This feature of control provides for economy of ointment, and from an esthetic point of view is desirable because the patient's lids and peri-orbital area are less apt to become unnecessarily smeared with the salve.

Using a larger syringe (10 cc.) this method permits the rapid treatment of large numbers of patients in the event of an epidemic of ocular infection, or in the event of a large number of eye casualties during a lewisite gas attack. Under these circumstances the syringe would contain BAL ointment. This method would also be useful in any large hospital with a busy eye clinic.

The syringe and spatula are easily sterilized before use, and loaded with the ointment; the tip of the syringe can be wiped with alcohol after each case.



PENICILLIN SENSITIVITY: ANGIONEUROTIC REACTION

After having been successfully treated with penicillin for gonococcus infection, urethra, two and one-half months previously, a 22-year-old boatswain's mate, second class, was given an initial 20,000 units dosage of penicillin for cellulitis, perineal region. Twenty-five minutes following the intramuscular injection he developed generalized urticaria, orbital edema completely closing both eyes, pain and effusion of the right wrist joint, and edema of the pharynx and larynx characterized by hoarseness and difficulty in swallowing. The edema of the pharynx was seen on inspection. Following one-half cc. of epinephrine, 1:1,000, he began to improve and within 24 hours the condition completely cleared.—**STRICKLAND, D. A.**, Lieutenant, junior grade (MC) U.S.N.R.



PENICILLIN AND RESISTANT STAPHYLOCOCCI

Coagulase-positive strains of staphylococci are occasionally encountered which possess a natural resistance to penicillin. While this biologic phenomenon may be conducive to therapeutic failures with penicillin, the resistance is relative and may be overcome with adequate doses of penicillin. For this reason it is recommended that adults having severe staphylococcic infections should receive a minimum of 200,000 units of penicillin each 24 hours during the initial stages of therapy.

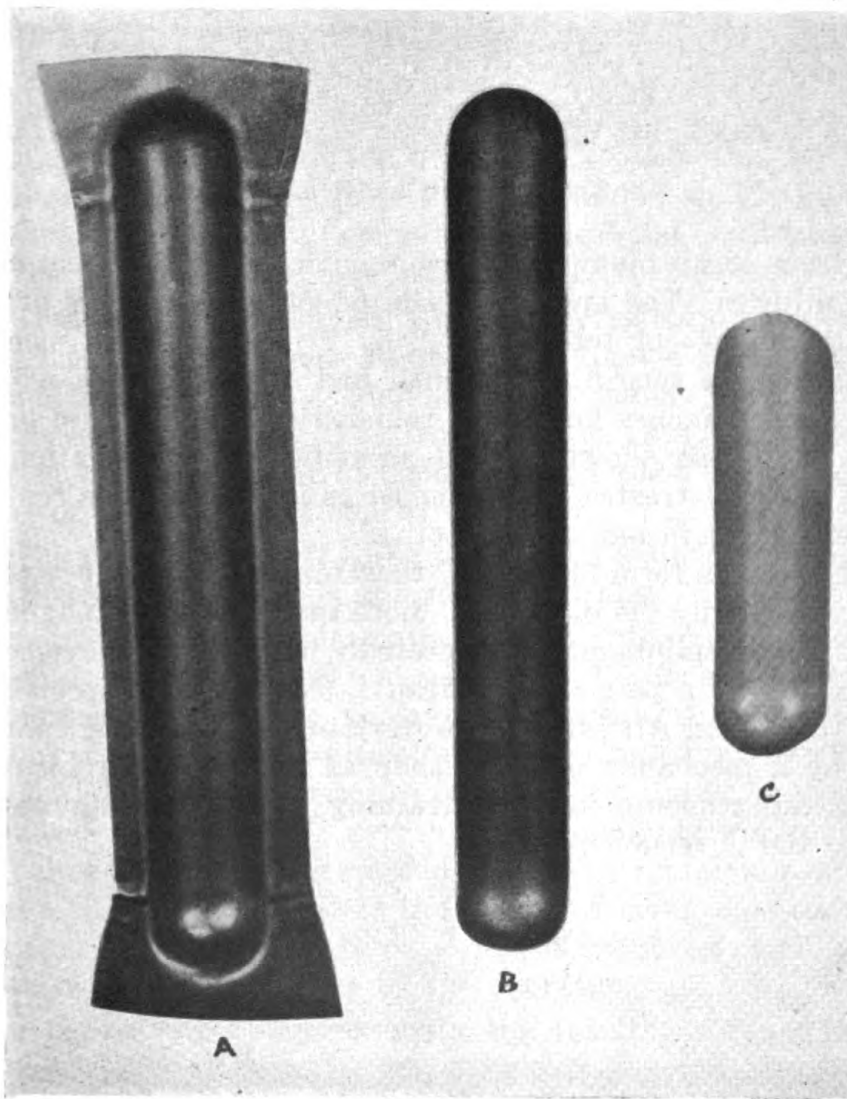
Since some strains of coagulase-positive staphylococci may show a resistance to penicillin but pronounced sensitivity to sulfathiazole or to sulfadiazine, it would appear desirable to utilize a combination of penicillin and sulfonamide therapy. However more clinical evidence is required.—**SPINK, W. W.**; **HALL, W. H.**; and **FERRIS, V.**: Clinical significance of staphylococci with natural or acquired resistance to sulfonamides and to penicillin. *J.A.M.A.* 128: 555-559, June 23, 1945.

METAL FINGER SPLINT

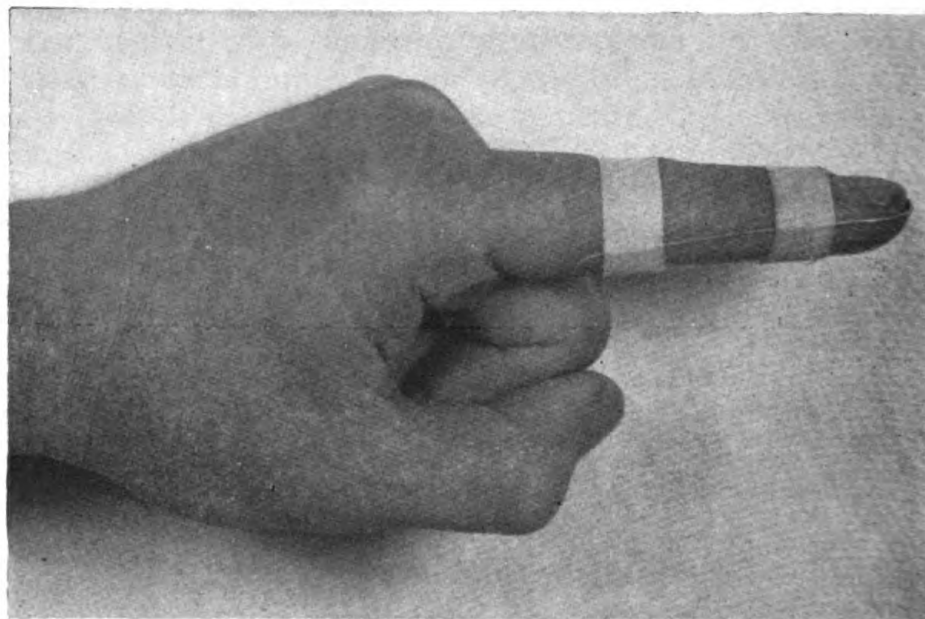
JAMES W. PACKARD, JR.

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A large proportion of injuries in shore establishments consist of lacerations, contusions, or fractures of the fingers. A simple and efficient finger splint, which may be produced in large num-



1. Stages in production of metal finger splint. (A) Scrap aluminum after being molded by drop hammer and die. (B) After being heat-treated and trimmed. (C) Finished splint cut and polished.



2. Metal finger splint in use.

bers from scrap aluminum, has been designed for treatment of these injuries. The splint is made of 24-SO-AL scrap, of 0.025-inch thickness, cut into pieces 2 by 7 inches. These pieces are run through a special drop punch and die made with a $\frac{7}{8}$ -inch radius and 6 inches long with rounded ends. The drop hammer forms strips as shown in the accompanying illustration. The strips are heat treated and trimmed as indicated. The remaining segment is cut in half and smoothed.

The splint is form-fitting and therefore adequately protects the finger, especially the distal end, more than the usual tongue blade splint. These splints may be repeatedly used and moreover may be cut shorter by a pair of tin snips, if necessary, for special cases.

At this Naval Air Station the work of producing the splint was done by a mechanic learners' shop as a training problem, thus giving the students valuable training and presenting no extra cost to the government.

EDITORIALS

INTERVERTEBRAL DISKS

Following through on the warning voiced in the editorial pages of this BULLETIN¹ over 2 years ago regarding the problem of intervertebral disk the time has come to make a critical evaluation of the surgical correction of this condition.

Awareness of the entity on the part of the examining surgeon contributed substantially to the increased frequency as reported in the literature. In the Navy this is reflected in the current comparative statistical data compiled by the Vital Statistics Section of the Bureau of Medicine and Surgery.

In 1942 there were 96 admissions for intervertebral disk among Navy and Marine personnel. In 1943 this number had increased to 330 and in 1944 to 607. That this is not simply a relative increase is seen by the fact that from 1942 to 1944 there was an increase of over 60 percent in incidence even when considered on the basis of rate per one hundred thousand.

A little more than half of these patients have undergone operation, with what success it is difficult to appraise.

Perhaps the most valuable compilation to date on this phase of the problem is seen in a recent report by White and Peterson² who reviewed the literature of the past ten years. A fairly critical evaluation of the results of operation for protruded intervertebral disk as found in civilian practice is given. Of the 947 cases collected it was shown that 68 percent of the patients were capable of returning to their former occupation. The remaining 32 percent were still incapacitated to the extent of being able to carry on only in a limited degree, some were not improved at all, while others were even made worse by the operation.

These figures are compared with the results as found in 46

¹ EDITORIAL: Problem of intervertebral discs. U. S. Nav. M. Bull. 41: 1455-1456, September 1943.

² WHITE, J. C., and PETERSON, T. H.: Lumbar herniations of intervertebral disks; value of surgical removal in Naval personnel. War Med. (In press.)

service personnel operated upon for this condition under White's supervision. Of the 46 patients, in all except 2 of whom a positive filling defect was visualized preoperatively by myelograph, typical herniation of the fourth and fifth lumbar intervertebral disks was removed in thirty-nine. In 6 patients other causes of root compression were found to be present, and in 1 a negative exploration resulted.

Follow-up studies on 39 cases of this series revealed that 16 of these patients, 9 of whom were commissioned officers, were benefited by the operation and were returned to their former active duty, 20 required a limited duty status, and 3 were surveyed from the service.

The seriousness of the problem of intervertebral disk in overall Navy personnel is further appreciated from a consideration of the breakdown figures constituting the 607 patients admitted for this condition in 1944. In the last 8 months of the last year, 367 persons³ were surveyed for disposition because of herniated intervertebral disk. Of this number only 20 were returned to full active duty status, whereas 127 were recommended for limited duty and 195 were invalidated from the service.

A condition with such a somber outlook is deserving the most critical scrutiny. An entity which at best can be promised only a 75-percent relief by surgical exploration, and which admittedly may be worsened by surgery, is entitled to an exhaustive analysis and a re-evaluation of its correction by surgical means.

In the light of end results it may be questioned whether or not the surgical approach to ruptured intervertebral disk is based upon sound physiologic dynamics. The pathologic anatomy is apparent, and removal by surgery appears justified. The prognosis, however, presents a fallacy, the answer to which may lie outside present-day open surgical methods.

³ PERKINS, O. C., and VICALÉ, C. T.: Intervertebral disk in Naval service. (In press.)

RATIONALE OF NEPHROPEXY

Urologists look askance at nephropexy. The delusive character of nephroptosis fosters this viewpoint. The motility of a kidney, particularly in an asthenic person, permits wide excursions of an otherwise normal organ. Every urologist has seen patients in

whom, while standing, a displaced kidney could be freely palpated, but on reclining for x-ray verification, for example, the organ assumed normal relationships. Consequently only a displaced kidney which provokes indisputable symptoms and one which has been subjected to conservative measures for some time is considered operable.

Whether this view obtains the greatest advantage to the patient may be questioned. Surgical fixation of a displaced kidney, when weighed against potential urinary tract disabilities occasioned by ptosis, is a matter of minor consequence. This is particularly true if the more physiologic forms of repair are employed. It has been shown^{1,2} that a movable kidney is the result of a defect in the fascial sheaths covering the renal fossa, defection of the anterior leaf being the usual offender. Anchorage of a kidney along an anatomic plane must consider these structures, as pointed out by Beneventi elsewhere in this BULLETIN, p. 685.

Any surgical treatment of a movable kidney should aim at fixation under as nearly normal conditions as possible. To string a kidney over a rib, as commonly practiced, suspended as it were from a rafter, is as conducive to a successful end result as it is to place a halter about one's own neck. Strangulation only can ensue, with all the painful sequelae of an unanatomic procedure.

Equally disastrous is the contrivance of any mechanical arrangement beneath the renal pelvis. Constrictive tissue bridges may develop, resulting in dangerous obstruction.

In quadrupeds the anterior sheath of the perirenal fascia alone supports the animal's kidneys. It is thick, the aponeurotic fibers are strong and dense, sufficient to restrain the kidneys from dropping down and embarrassing the abdominal contents.

The upright position in man, however, calls for less strain; hence though the same architecture is followed the aponeurotic sheaths are thin, even defective at times, fading away into the surrounding areolar tissue, discerned and dissected with difficulty.

Suturing, therefore, of the anterior to the posterior leaf is the simplest form of nephropexy and the most physiologic. It is nature's own way of confining the kidney in its fossa; it presents a new aspect of the surgical fixation of the movable kidney. The simplicity of technic, moreover, recommends itself to all surgeons contemplating nephropexy.

¹ ZIEMAN, S. A.: Nephropexy. *Urol. & Cutan. Rev.* 42: 554-556, August 1938.

² LOWSLEY, O. S., and KIRWIN, T. J.: *Clinical Urology*, Vol. 2. The Williams and Wilkins Co., Baltimore, Md., 1944. p. 1620.

ALLERGIC REACTION TO PENICILLIN

Determination of agents responsible for allergic response in sensitive persons is not a simple procedure. The many factors to be controlled are not always accessible even when there is evidence pointing to their positive incrimination.

Sullens' report in this BULLETIN, p. 752, of a severe reaction to penicillin, brings up the difficulty of determining the source responsible for the allergic reaction. Penicillin as presently employed is admittedly not a pure product. The many variables it contains have been discussed editorially in previous issues of the BULLETIN.¹ Until the pure crystalline components constituting crude penicillin can be fractionated in sufficient quantities to permit their use therapeutically, incrimination of penicillin in allergic responses must be held in abeyance.

Sir Alexander Fleming recently called attention to the fact that therapeutic variations in penicillin should not be attributed to the calcium or sodium components of the preparation, but rather to impurities contained in the manufactured crude product. It is entirely reasonable to expect that when any one of the several crystalline penicillin components is used in a purified form, not only will there be consistent therapeutic response but side reactions will be of extremely rare occurrence if not entirely eliminated.

Feinberg² has shown that penicillium spores constitute 11 percent of the fungus spore content of the air in midwestern United States, and approximately 6 percent of allergic persons in that area are sensitive to the antigen of the penicillium family. Skin tests in these persons, employing the solid penicillin as well as a freshly prepared solution containing 5,000 units per cc., had negative results. Furthermore intracutaneous tests in 5, 50, and 500 units per cc. concentrations elicited negative response.

From these experiences it may be concluded that penicillium-sensitive persons are safe from allergic reactions to penicillin despite the enormous quantitative variations between the maximum dose for skin testing (0.02 cc. of a 500 unit per cc.), and the normal 200,000 units therapeutic daily administration of the drug.

The deduction, however, does not eliminate entirely the probability of allergy to penicillin, the inference being that commercial penicillin induces little or no allergic reaction even in penicillium-sensitive persons. Penicillin as administered therapeutically has

¹ EDITORIAL: Penicillin failures. U. S. Nav. M. Bull. 44: 1083-1084, May 1945.

² FEINBERG, S. M.: Penicillin allergy; on probability of allergic reactions in fungus-sensitive individuals; preliminary experiments. J. Allergy 15: 271-273, July 1944.

been for the most part in solution form and frequently given intravenously. The great likelihood of systemic allergic reaction from this mode of administration perforce must be taken into account. Pyrogen-free distilled water is difficult enough to obtain.

Consideration of the manufacturing process in the preparation of penicillin, and the final crude gross product which is employed therapeutically, leaves less wonderment of the fact that an occasional allergic response occurs; rather it is amazing that more severe and disconcerting side reactions are not encountered.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.
(For review)

TEXTBOOK OF MEDICAL TREATMENT, by various authors, edited by *D. M. Dunlop, B.A. (Oxon.), M.D., F.R.C.P. (Edin.), M.R.C.P. (Lond.), Professor of Therapeutics and Clinical Medicine, University of Edinburgh; L. S. P. Davidson, B.A. (Camb.), M.D., F.R.C.P. (Edin.), F.R.C.P. (Lond.), Professor of Medicine and Clinical Medicine, University of Edinburgh; J. W. McNee, D.S.O., D.Sc., M.D. (Glas.), F.R.C.P. (Edin.), F.R.C.P. (Lond.), Physician, H.M. the King in Scotland; with a foreword by the late Professor A. J. Clark, B.A. (Camb.), M.D., D.P.H., F.R.C.P. (Lond.), F.R.S., formerly Professor of Materia Medica, University of Edinburgh.* 3d edition. 1218 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price \$8.

This text by English authors deals with the particulars of treatment at greater length than is usually seen in similar works originating in this country. While the subject matter is sometimes rendered top-heavy by these minutiae, the careful reader will be compensated for his perusal of this book. It will remind him how readily he slips into the habit of overlooking the many useful adjuncts to therapy, meanwhile placing full reliance on one major therapeutic agent. A general knowledge of nursing principles can be gleaned from this volume, which, though ordinarily not of concern to the physician, may occasionally be fruitful.

Wherever possible the authors have attempted to name the one best therapeutic agent or combination of agents for each disorder, avoiding involved discussion of controversial measures. Consequently in those instances where the reader really wants help, reference to this text will usually be rewarded by unequivocal opinions to assist him in making decisions.

A disadvantage for American readers is the British terminology of diseases and trade names for medicinals. Also, though possibly we are too willing to label some of their therapeutic measures as old-fashioned, there is in this volume an occasional annoying adherence to outdated principles of therapeutics.

The subject matter is well arranged and is sufficiently inclusive to enable one to find an immediate answer to most of the everyday problems in treatment. The edition, however, is not of such recent publication as to include penicillin and allied antibiotics. For this and other above-mentioned reasons, it is not to be relied upon as the sole reference text in cases of indecision. With these reservations, its addition to the ready-reference shelf of the general practitioner or internist is worth considering.

THE MARCH OF MEDICINE—The New York Academy of Medicine Lectures to the Laity—1944. 121 pages. Columbia University Press, New York, publishers, 1945. Price \$1.75.

This present volume of "The March of Medicine" is the ninth in the annual series of "Lectures to the Laity" delivered under the auspices of The New York Academy of Medicine. It is up to its preceding sister volumes in that it records an interesting series of diversified presentations by experts in the various fields of scientific endeavor connected with or allied to medicine.

In the first lecture Dr. Edward A. Strecker discusses "Morale and Propaganda" and skillfully weaves into his talk the relationship between military neuropsychiatry and morale. In the second lecture Dr. Charles Glenn King discusses "Food and Civilization" and points out the need for more intensive research in the science of nutrition. He relates the high incidence of Selective Service rejections because of bad teeth to a widespread incidence of malnutrition in the United States.

The third lecture by Dr. Colin MacLeod is concerned with "The Past, Present, and Future of Chemotherapy." He traces the relatively young science of chemotherapy from its birth and baptism (it was Ehrlich who introduced the term) to its present noteworthy bid for fame with penicillium. He believes that chemotherapy "is yet a young immature branch of science which has only begun its contributions to the fundamental knowledge of life processes."

Reginald Fitz contributes a delightful chapter entitled "Medicine and Change," while Sir Gerald Campbell discusses "The Effects of Science upon Human Beings." The final lecture is entitled "War and Epidemics" by Lieutenant Colonel Thomas T. Mackie, M.C., A.U.S.

Beginning with a discussion of propaganda which in modern times precedes war, the volume ends with a consideration of epidemics which follow in the wake of war. This little volume will make interesting reading for intelligent laymen and it possesses the virtue of containing only 121 pages.

INTERNAL MEDICINE, Its Theory and Practice, In Contributions by American Authors, edited by *John H. Musser, B.S., M.D., F.A.C.P., Professor of Medicine in the Tulane University of Louisiana School of Medicine*. 4th edition; thoroughly revised. 1518 pages; illustrated. Lea & Febiger, Philadelphia, Pa., publishers, 1945. Price \$10.

This is the fourth edition of a highly successful textbook on internal medicine, edited by John H. Musser with numerous contributors. There has been a thorough revision and several new authors have been added. There are a total of 33 eminent contributors. As is always the case in such a volume the method of presentation varies with the author and there is considerable variation of quality. A chapter on bacillary diseases is extensive and outstanding. Occasional dogmatic, and sometimes amusing, statements appear, an example being that the temperature of the sick room should be kept at 70° Fahrenheit. The common mistake is made of prescribing the amount of immune globulin or convalescent serum which should be administered, without stating by what route. Since this is primarily a textbook for students such an omission is hardly warranted. This textbook has rapidly become one of the foremost in the field. The fourth edition is an improvement on an already fine work.

THE 1944 YEAR BOOK OF INDUSTRIAL AND ORTHOPEDIC SURGERY, edited by *Charles F. Painter, M.D., Orthopedic Surgeon to the Massachusetts Women's Hospital and Beth Israel Hospital, Boston*. 432 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1945. Price \$3.

In this era of trauma on a global scale opportunities for advancement in orthopedic surgery have occurred to an extent man has never before known. This in conjunction with the opportune discoveries in the field of chemo- and biotherapeutics has resulted in accelerated developments in which one year's yield may encompass as much as a decade of research in previous years. Toward this end a compilation of a year's important articles should contribute much to those who by the nature of their service to their country must forego the luxury of reading current medical literature.

Unfortunately a limitation has been imposed on a collection of this nature the essence of which is its timeliness, by delaying its publication until 1945 while including 1944 in its title, and when actually a great many of the articles appeared originally in 1943.

This handicap is apparently accepted and compensated for by the inclusion of a number of articles on technic, whose value is not so readily diminished by the passage of time. But in general, the emphasis in the choice of articles extracted is given to those with current significance. Intramedullary fixation of fractures is represented by James A. Dickinson's article. The use of plastic materials such as Lucite and Nylon fabric in orthopedic surgery is presented. Fatigue fractures of the ankle and hip are described. Rehabilitation in general receives increasing attention. The trend toward critical evaluation of bed rest in treatment has now appeared in orthopedic surgery following its thorough study in cardiac patients and the recent demonstration of its many physiologic shortcomings.

Worthy of special mention is a compact chart summarizing the chemical findings in Neoplastic Disease of Bone tabulated originally by Woodard in *Archives of Surgery* for October 1943.

The bland, personal and scholarly observation of the editor at the end of certain of the articles adds a stabilizing influence to some of the more enthusiastic proponents and in general enhances the material.

Aspiring to a large volume of sale with the requirement that the contents have popular appeal, the volume is of decidedly limited value to the finished orthopedic surgeon who would gain more from reading the year's work in orthopedics in *International Abstracts of Surgery* and other similar abstracts, were he to attempt to regain a year's loss of current reading in his specialty.

CLINICAL HEART DISEASE, by Samuel A. Levine, M.D., F.A.C.P., Assistant Professor of Medicine, Harvard Medical School; Physician, the Peter Bent Brigham Hospital, Boston; Consultant Cardiologist, Newton Hospital; Physician, New England Baptist Hospital, Boston. 3d edition; revised and reset. 462 pages; 157 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1944. Price \$2.

This is the third edition of this excellent book on heart disease, which has been so well received in the two previous editions. Recent developments have been incorporated including the use of penicillin in the treatment of subacute bacterial endocarditis. The section on electrocardiography is much more extensive than in the previous edition. This is a decided improvement since the text now becomes a more complete reference book for the average reader. Recognizing the growing importance of photography of heart sounds, the concluding chapter is devoted to this subject.

FAMILIAL SUSCEPTIBILITY TO TUBERCULOSIS, Its Importance as a Public Health Problem, by Ruth Rice Puffer, Dr.P.H., Tennessee Department of Public Health. 106 pages. Harvard University Press, Cambridge, Mass., publisher, 1944. Price \$2.

This monograph is a résumé of the previously published opinion and statistical studies concerning the relative importance of familial susceptibility and person-to-person contact in the spreading of tuberculosis. This is followed by a statistical study of parents children, and siblings of tuberculous patients in the State of Tennessee.

The purpose of the monograph seems to be to re-emphasize the importance of careful examination and continued observation, not only of the domiciliary contacts of a tuberculous patient, but also of all members of his family whether actual contacts or not. Since this concept is not new, the author's work is not considered an original contribution. It is, however, a valuable reference.

THE AVITAMINOSES, The Chemical, Clinical and Pathological Aspects of the Vitamin Deficiency Diseases, by *Walter H. Eddy, Ph.D., Emeritus Professor of Physiological Chemistry, Teachers College, Columbia University and Gilbert Dalldorf, M.D., Pathologist of the Grasslands and Northern Westchester Hospitals, Westchester County, New York.* 3d edition. 432 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price \$4.50.

This is a well-written book containing much information and in general, adequate bibliographic support. The subject of avitaminoses is a difficult one, since much of it relates to animal experiments and its application to man is not always known. In this regard considerable conclusion is drawn from inference. There is one part of the text where this is particularly exemplified, i.e. the section on the vitamins and infectious diseases. The authors' conclusions regarding specific interrelationship between avitaminotic states and infections are unwarranted, since morbidity, cachexia, etc., may be the prevalent factors contributing to degree of infection. Regardless of these few extraordinary claims made for the vitamins, the book is in itself a sober text and describes in considerable detail the pathology and related biochemistry of each vitamin deficiency. In this respect it is the best of its kind in this field.

CLINICAL ROENTGENOLOGY OF THE DIGESTIVE TRACT, by *Maurice Feldman, M.D., Assistant Professor of Gastroenterology, University of Maryland.* 2d edition. 769 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1945. Price \$7.

This book is compiled of subject material of great value to any medical officer dealing with diagnostic problems of the gastrointestinal tract. It consists of succinct and clear descriptions including normal findings, anomalies and abnormal changes encountered by the roentgenologist. Related subjects on clinical manifestations and pathologic findings and differential diagnosis

are included where these are applicable. The findings of each condition which indicated the roentgen diagnosis are listed with each subject, indicating clearly what findings are diagnostic for the condition in question.

The arrangement of the subject matter is simple and easily followed. The numerous roentgenograms are well chosen and illustrate the text to good advantage, making this volume a valuable reference book for the roentgenologist. To the clinician it can be a valuable guide in correlating the roentgen findings with clinical findings. Individual chapters cover subject matter pertaining to the intestinal tract and other organs affecting roentgen diagnosis of the gastro-intestinal tract.

This book would be an asset to any medical library and especially to the library of the specialists engaged in training candidates of the specialties of roentgen diagnosis and gastro-enterology.

ARITHMETIC OF DRUGS AND SOLUTIONS, by *E. Justin Hills, Ph.D., Mathematics Department, Los Angeles City College; and Angeline Polley, M.S., R.N., Civil Health Department, Los Angeles City College.* 63 notebook pages. W. B. Saunders Co., Philadelphia, Pa., publishers, 1945. Price 75¢.

This publication is a loose-leaf outline prepared for classroom instruction in nursing procedures. It could be a valuable reference for anyone in the medical profession wishing to review basic mathematics. The subject matter with examples and exercises includes integers and decimals, fractions, percentage, proportion, solutions and dosages.

The value of and need for a reference such as this is paramount among adults. It is deplorable that so few people can solve simple problems in addition, subtraction, multiplication and division without a vast amount of mental gymnastics. This outline attempts to simplify procedures. A few errors in procedures, and an unintentional tendency toward complication rather than simplification, however, detract from this otherwise laudable publication. If the answers to problems were given, it would increase the value considerably.

TRAPPING THE COMMON COLD, by *George Sanford Foster, M.D.* 125 pages. Fleming H. Revell Co., New York, publishers, 1945. Price \$1.25.

"Trapping the Common Cold" might better have been called "By-passing the Common Cold," as such is the strategy laid down by the author for the average citizen who wishes to avoid that common, recurrent, troublesome and serious syndrome—the common cold.

In 13 brief chapters spread over 125 pages the reader is inter-

estingly carried to an intimate understanding of the factors which lead to and constitute a "common cold," and how, through relatively simple procedures, the omnipresent "cold" is avoided. It is not a technical manual or a résumé of taboo and fetish but a sound and practical explanation of the principles of right living which, when followed, do reduce morbidity days caused by the common cold.

MEDICAL USES OF SOAP, A Symposium, by *G. Thomas Halberstadt, B.S.Ch.E.; Marion B. Sulzberger, M.D.; Theodore Cornbleet, M.D.; Lester Hollander, M.D.; C. Guy Lane, M.D.; Daniel J. Kooyman, Ph.D.; Rudolf L. Baer, M.D.; Carey McCord, M.D.; Morris Fishbein, M.D.; and Irving H. Blank, Ph.D.* 182 pages; 41 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1945. Price \$3.

The information presented in this collection of articles is not as limited as the title implies. The first section of the book deals with the chemistry and the manufacture of detergents and the principles and the factors of cleansing action. This informative and interesting background is followed by sections on the usual and the unusual effects of soap on the "normal" and the diseased skin. Additional chapters on the effects of soap on the hair, the use of soap for shaving, soap problems in industries, and medical uses of soap and the cutaneous detergents other than soap, make the book an excellent reference.

It is recommended for those who would have a more thorough understanding of the many problems associated with the everyday use of cutaneous detergents.



PENICILLIN ABSORPTION FROM BODY CAVITIES

Injection of 120,000 units of penicillin into a pleural cavity after aspiration of an effusion ensured a bacteriostatic concentration of the drug in the blood stream for 24 hours or more; 240,000 units produced a similar effect for about 48 hours. Injection of 120,000 units into two intact but infected knee joints produced the same effect for at least 13 hours in one case and 24 hours in the other. Injection of 120,000 units in 2 adults, and its equivalent in an infant, into the intrathecal space produced the same effect for about 15 hours. The protracted systemic effect due to slow absorption does not appear to be an exclusive property of serous membranes, but is also associated with cavities in the body not lined with such membranes, such as abscess cavities. Clinical application of these findings has already given good results.—FLOREY, M. E., and HEATLEY, N. G.: Systemic administration of penicillin by absorption from body cavities. *Lancet* 1: 748-751, June 16, 1945.

PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge

TOXIC EFFECTS OF ARSENICAL COMPOUNDS

AS ADMINISTERED IN THE UNITED STATES NAVY
IN 1944, WITH SPECIAL REFERENCE
TO ARSENICAL DERMATITIS

OTTO L. BURTON

Captain (MC) U.S.N.

GEORGE W. JUSTYN

Chief Pharmacist U.S.N.

and

LAURA T. ANDERSON

For the past 20 years medical officers of the Navy have been required to submit to the Bureau of Medicine and Surgery reports of the number of doses of arsenicals administered and the reactions therefrom. This information has been compiled and published in the following issues of this BULLETIN:

September 1925.	October 1934.	October 1938.	October 1942.
January 1927.	January 1935.	January 1939.	January 1943.
January 1929.	October 1935.	October 1939.	November 1943.
July 1930.	January 1936.	January 1940.	January 1944.
October 1931.	October 1936.	October 1940.	October 1944.
October 1932.	January 1937.	January 1941.	January 1945.
April 1933.	October 1937.	October 1941.	
October 1933.	January 1938.	January 1942.	

In table 1 is shown the number of doses of each arsenical administered in the year 1944, together with the number and type of reactions, and similar data for the 20-year period, 1925 through 1944. It is noted that in 1944 there was 1 untoward reaction to every 4,952 doses and 1 death to every 49,518 doses. For the 20-year period there was 1 reaction to every 1,995 doses and 1 death to every 41,226 doses.

ARSENICAL DERMATITIS

Dermatitis in some form was included in 26, or 32 percent of

TABLE 1.—*Arsenicals, U. S. Navy, 1944 and 1925-44; type of drug, reaction, and ratio of doses to reactions*

	Number of doses administered	Reactions				Ratio of reactions to doses 1 to —	Ratio of deaths to doses 1 to —
		Mild	Severe	Fatal	Total		
Year 1944:							
Bismarsen	190	0	0	0	0	0	0
Maparsen	381,475	38	24	5	67	5,694	76,298
Neorsphenamine	12,398	4	6	3	13	954	4,133
Sulfarsphenamine	54	0	0	0	0	0	0
Tryparsamide	2,027	0	0	0	0	0	0
Total	396,144	42	30	8	80	4,952	49,518
20-year period 1925-44:							
Acetarsone ¹	1,013	1	0	0	1	1,013	0
Arsphenamine	41,558	27	14	1	42	989	41,558
Bismarsen ²	4,812	0	0	0	0	0	0
Maparsen ³	1,006,951	104	63	6	173	5,821	167,829
Neorsphenamine	1,392,838	648	332	54	1,034	1,347	25,790
Silver arsphenamine ⁴	591	0	1	1	2	296	591
Sulfarsphenamine	30,989	17	8	0	25	1,239	0
Tryparsamide	77,242	3	1	0	4	19,311	0
Total	2,555,994	800	419	62	1,281	1,995	41,238

¹ First administered during the year 1932.² First administered during the year 1929.³ First administered during the year 1935.⁴ First administered during the year 1931.TABLE 2.—*Proportion of reactions of various types, 1929-44*

Classification	Number of reactions	Percent of total reactions
Arsenical dermatitis.....	405	38.7
Vasomotor phenomena.....	368	35.2
Liver damage.....	63	6.0
Reactions of minor importance.....	50	4.7
Blood dyscrasias.....	46	4.4
Jarisch-Herxheimer reaction.....	30	2.8
Table reaction.....	26	2.4
Gastro-intestinal disturbance.....	23	2.2
Hemorrhagic encephalitis.....	11	1.0
Acute renal damage.....	4	.3
Arsenical hypersensitivity.....	3	.2
Optic neuritis.....	3	.2
Arsenical neuritis.....	3	.2
Toxic encephalopathy.....	2	.1
Liver damage (doubtful reaction).....	2	.1
Vascular damage (probable adrenal hemorrhage).....	1	.1
Polynuritis.....	1	.1
Borderline hemorrhagic encephalitis.....	1	.1
Fever.....	1	.1
Circulatory collapse.....	1	.1
Total.....	1,044	100.0

the total reactions in 1944, as compared with 54 percent for 1943. The type of lesion was exfoliative in 10 instances, macular in 4, erythematous in 3, urticarial in 3, papular in 2, maculopapular in 1, morbilliform in 1, pustular in 1 and vesicular in 1. The reactions were classified as 10 mild and 16 severe.

Mild reactions.—The 10 mild reactions occurred after the following number of injections: One after the second, four after the fourth, and one each after the ninth, nineteenth, twenty-second and twenty-seventh. One was not reported. The interval between

the injection and appearance of symptoms ranged from 1½ hours to 6 days. The length of time required for complete recovery varied from 3 days to 8 weeks. Three patients were transferred to hospital facilities for treatment. One patient was kept on duty status and completed recovery in 3 months.

MAPHARSEN

Case 1—1944.—After exposure to infection in December 1943, this patient developed a penile lesion. He did not report to the sickbay and the lesion disappeared in a few days. Secondary symptoms were found during examination for discharge on 1 May 1944, and the diagnosis was confirmed by a Kahn blood test which was 4-plus.

Arsenical treatment was begun with a 0.6-gm. injection of neoarsphenamine on 11 May 1944, followed by 0.06-gm. injections of mapharsen on 15, 17 and 23 May. Four hours after the last injection the patient noticed a few red spots on his right wrist which itched. Within a few hours his entire body was covered with an itching rash. Complete blood count showed 4,870,000 erythrocytes and 19,700 leukocytes per cu. mm., with 5 percent band forms, 74 percent segmented cells, 18 percent lymphocytes, and 2 percent eosinophils.

Treatment consisted of a sodium bicarbonate bath, followed by the application of boric acid ointment, and administration of calcium lactate, grains 30; propadrine hydrochloride, grain ¾, was given three times daily. Recovery was complete in 5 days.

Case 2—1944.—After exposure to infection on 29 January 1944, this patient developed a typical primary lesion. A darkfield examination showed *Treponema pallidum* on 25 February 1944.

From 25 February to 23 May, he received nine injections of mapharsen, a total of 0.42 gram, and nine injections of bismuth subsalicylate, a total of 1.32 grams. The following note was made in the patient's health record on 16 March 1944: "This man had a severe reaction from his fifth injection of mapharsen which caused a severe febrile reaction and a leukopenia (2,000). It is recommended that mapharsen not be given for 1 or 2 months, and then resumed carefully in small graduated doses, and that he be treated on the old plan of one injection per week."

The patient was placed on the 26-week treatment routine and it was during the eighth week of treatment that the reaction occurred. He was admitted to the dispensary on 29 September, complaining of pruritic rash of 3 hours' duration. He stated that he had received an injection of mapharsen at 1500 and that he had felt nauseated and chilly immediately. At 1800 he noted that a faint rash, which had appeared after the previous injection, became very pronounced and moderately pruritic.

Physical examination at the time of admission showed a generalized macular eruption tending to become confluent over the entire body, excluding the palms and soles. A complete blood count was within normal limits, and the urine was essentially normal except that the specimen was loaded with amorphous urates. His clinical course during hospitalization was uneventful and no treatment was deemed indicated. Recovery was complete in 4 days.

Case 3—1944.—After exposure to infection on 28 July 1944, this patient developed a penile lesion which was clinically that of primary syphilis. Dark-field examinations yielded negative results. Eight Kahn blood tests, done between 11 August and 5 September, were 4-plus.

Arsenical treatment began with a 0.03-gm. injection of mapharsen on 21 August 1944 and was followed by a 0.04-gm. injection on 25 August, and a 0.06-gm. injection on 28 August.

Eleven hours after the last injection the patient developed a fever of 102.8° F. without any other complaints. The dosage was decreased, and he was given a 0.04-gm. injection on 1 September. Within 2 hours the temperature rose to 103° F., and 4 hours later there was a diffuse morbilliform eruption covering the trunk; the skin reaction was associated with nausea and vomiting. The eruption remained for about 18 hours and the temperature rose to a maximum of 105° Fahrenheit. Examination showed no abnormalities except for minimal stiffness of the neck, the eruption, and a rapid pulse.

He was given abundant fluids and fruit juices reinforced with lactose. BAL in peanut oil was injected intramuscularly, 1.5 cc. every 4 hours for 4 doses and then every day for 7 days. In 24 hours the eruption had subsided and the temperature was normal. After 3 days he was given infusions of 1,000 cc. of 5-percent dextrose in saline. Recovery occurred in 4 days.

Case 4—1944.—Following exposure to infection in July 1944, this patient developed a linear ulceration at the base of the penis, measuring 3 by 1 cm., with raised soft edges and a dirty gray base, associated with left inguinal adenopathy. Darkfield examinations showed the presence of *Treponema pallidum*.

Arsenical treatment was begun with 0.06-gm. injections of mapharsen on 14, 19 and 22 September 1944. Three hours after the last injection the patient's temperature rose to 102° Fahrenheit. He was given a 0.03-gm. injection of mapharsen on 26 September and 6 hours later developed a fever of 105° F., and a generalized macular rash. Urine specimens were normal with the exception of occasional leukocytes and epithelial cells.

Treatment consisted of bed rest, applications of zinc calamine lotion, and administration of $\frac{1}{2}$ grain of morphine. Recovery was complete in 3 days.

Case 5—1944.—A penoscrotal lesion was diagnosed by darkfield examination on 29 June 1944. A few days after completion of therapy on 12 December, the patient complained of severe pruritus, and erythematous macules were seen on the legs and forearms. There was also diffuse erythema over the thighs and in patches elsewhere. No other cause being found, this reaction was considered to be a mild dermatitis due to arsenicals.

Application of bland ointments, administration of vitamin supplements and daily infusions of calcium gluconate were instituted. The lesions underwent rapid involution and had practically disappeared by 30 December.

Case 6—1944.—This patient was exposed to infection in August 1944, and the diagnosis of syphilis was confirmed by darkfield examination and a 4-plus Kahn blood reaction on 10 October.

Within a few hours after the nineteenth injection on 7 December, the patient reported to the sickbay with an urticarial rash, a temperature of 100° F., and pulse rate of 90 per minute. There was intense itching. Three days later no change was noted in the rash or the symptoms. The patient

was transferred to a hospital on 10 December with the diagnosis of syphilis, and poisoning, therapeutic, mapharsen.

Case 7—1944.—Exposure to infection in this case occurred in June 1943. Positive findings in darkfield examinations were obtained from penile lesions in August. The patient also had bilateral, shotty, nontender adenitis. The Kahn blood reaction was 3-plus on 12 August.

Treatment was started on the following day with mapharsen and bismuth. Twenty-seven 0.03-gm. injections of mapharsen were given between 13 August and 4 September. Severe urticaria resulted. The patient had had two reactions previously, but the cause was doubtful at the time. After the injection on 4 September the patient complained of general malaise. About 1½ hours after treatment his skin began to itch, and red raised areas were distributed over the body from the waist to the toes. The temperature was 99.2° Fahrenheit.

Calamine lotion was applied locally and ¾ grain of ephedrine hydrochloride was given. The patient was transferred to a hospital ship.

Case 8—1944.—This patient developed a penile lesion after exposure to infection in December 1942. A darkfield examination on 22 January 1943 showed *Treponema pallidum*. Between this day and 26 March the patient received 16 injections of mapharsen, a total of 0.92 gram. Kahn blood tests were negative on 2 and 3 February 1944.

The course of treatment during which reaction occurred was started on 15 August 1944, and between this day and 27 December the patient received six injections of mapharsen, a total of 0.36 gram, and 15 injections of bismuth.

Six days after the 0.06-gm. injection of mapharsen on 27 September the patient complained of mild itching. Mapharsen was discontinued and anti-syphilitic treatment continued with bismuth. Three weeks later the papular eruption on the groin and scrotum had become generalized and the itching intense. Kahn blood test and spinal fluid were negative. Generalized flat-topped angular papulosquamous lesions and an eruption resembling lichen planus appeared. The erythrocyte count was 4,900,000, and the leukocyte count 6,500, with 6 percent eosinophils. The hemoglobin concentration was 95 (Talqvist method). The patient was given 1-cc. intramuscular injections of liver extract twice a week for three weeks and two injections of sodium thiosulfate, 10 cc. of 10-percent solution.

The patient was returned to duty under treatment on 22 November.

NEOARSPHENAMINE

Case 9—1944.—This patient was hospitalized on 6 August 1944 with the diagnosis of gingivitis, Vincent's, after he failed to respond to ambulatory treatment following dental extraction. Treatment with neoarsphenamine was begun with a 0.3-gm. injection on 13 August, a 0.45-gm. injection on 16 August, and a 0.6-gm. injection on 19 August. Four hours after the last injection the patient had a chill and an acute febrile course was noted for 3 days. The chill was followed by the appearance of a fine macular rash over the thorax, abdomen, and extremities. Specific treatment consisted of sodium thiosulfate, 1 gm. intravenously. Recovery was complete in 12 days.

Case 10—1944.—After exposure of this patient on 25 November 1944, diagnosis was made by the appearance of a typical penile lesion and positive darkfield findings on 15 December. Antisyphilitic treatment was begun on

16 December with a 0.45-gm. injection of neoarsphenamine, followed by a 0.6-gm. injection on 21 December.

Symptoms consisted of a diffuse erythematous rash, more prominent over the cubital spaces, axillae, and abdomen. This reaction occurred 4 days after the last neoarsphenamine injection. Neoarsphenamine was discontinued, and the rash disappeared 3 days after its appearance. The Kahn blood test was negative on 15 December and Wassermann tests were positive on 29 December. The condition of the patient is satisfactory.

Severe reactions.—The sixteen severe reactions occurred after the following number of injections: Two each after the fourth, seventeenth and nineteenth, and one each after the first, fifth, eighth, ninth, twelfth, twenty-first, twenty-seventh, twenty-ninth, thirty-fifth and forty-ninth injections. The interval between the injection and the appearance of symptoms varied from 30 minutes to 6 days. The length of time required for recovery varied from 7 to 53 days. The recovery time was not reported in 3 instances.

MAPHARSEN

Case 11—1944.—After exposure to infection on 20 June 1943, this patient developed 3 initial lesions on the inner aspect of the prepuce of penis. On 9 August a darkfield examination showed *Treponema pallidum*. Kahn blood tests were negative on 9 August and 23 September.

From 9 August to 16 September, he received 7 injections of neoarsphenamine, a total of 3.6 grams. He was admitted to a Naval hospital on 14 September with diagnosis undetermined (dermatitis medicamentosa) which was believed to be the result of neoarsphenamine. On 16 September the diagnosis was established as dermatitis medicamentosa.

After discharge from the hospital he received 10 injections of bismuth subsalicylate, a total of 1.93 grams. On 21 February 1944 the patient was given the first injection of a second course of arsenical treatment (mapharsen) and in view of the previous dermatitis medicamentosa, a dose of 0.006 gm. of mapharsen diluted in 10 cc. of water was given intravenously at 1010. Upon awakening at 1505 the patient noted a "full" sensation of his hands and reported immediately to the sickbay. In addition to a moderate swelling of both hands, small papules were also noted over the area. The patient was afebrile. At 2245 a generalized flushing was noted and he complained of slight itching. He was still afebrile.

On 22 February papules were present on the upper extremities, the eyelids were moderately edematous, and the flush was still present. Urinalysis at this time showed a specific gravity of 1.036. Ten cc. of a 10-percent solution of calcium gluconate was given intravenously with almost immediate temporary relief from the itching. Treatment thereafter consisted of bed rest and abundant fluids. Urinalysis showed a specific gravity of 1.022, with 10 or 11 leukocytes. In the afternoon of 22 February a fine pustular rash appeared circum-orally, which persisted for 3 days, and a similar rash appeared on the hands and forearms, persisting until several days before discharge. After a mild desquamation of the face, neck, and arms, the patient was returned to duty completely well in 7 days.

Case 12—1944.—After exposure to infection in November 1943 this patient

veloped an initial lesion posterior to the coronal sulcus of the penis. Dark-field examination was positive for *Treponema pallidum*.

From 4 January to 12 March 1944 he received 18 injections of mapharsen, total of 1.06 grams. Seven injections of bismuth were given as concurrent treatment. The day following the eighteenth injection of mapharsen the patient reported to sick call complaining of itching when his body was warm. Examination revealed generalized dry scaling of the entire body and the extremities. The scales were moderately large and there was no secondary infection. There was swelling of the postcervical and axillary nodes. There were no other symptoms, general or local. He was admitted with the diagnosis of dermatitis, drugs, since it was felt that this condition was due to use of the arsenical. A complete blood count was within normal limits except for a slight leukocytosis.

BAL ointment was applied once daily for the first 3 days, alternately on the limbs and the buttocks, and the condition seemed somewhat improved. Calcium lactate, grains 15 three times a day, was orally administered. On the fourth day the patient seemed much improved and treatment was changed. Lanolin applied to the whole body once daily, and administration of ephedrine sulfate, $\frac{3}{4}$ grain three times a day. Although some slight generalized itching of the skin was evident, the patient was much improved and was considered fit for duty. Recovery was complete in 11 days.

Case 13—1944.—After exposure to infection on 31 December 1943, this patient developed a small chancre on the right side of the frenum. A dark-field examination and a Kahn blood test were positive on 17 January 1944. From 17 January to 4 March he received 21 injections of mapharsen, a total of 1.23 grams, and 10 injections of bismuth.

Ten hours after the last injection of mapharsen the patient developed a vesicular eruption on the flexor surfaces of the arms and on the medial aspect of the thighs. The eruption was typical of arsenical dermatitis.

No treatment was given for one week. A 0.03-gm. injection of mapharsen was given which caused a recurrence of the eruption and a slight itching. The eruption was exactly similar to the first episode. Several shallow weeping ulcers developed on the side of the glans penis. Darkfield findings at that time were negative, and the ulcers healed under a regimen of frequent cleansing and application of sulfanilamide powder. Recovery occurred in 11 days, but treatment was continued with bismuth twice weekly for 20 weeks.

Case 14—1944.—One month after exposure to infection on 15 May 1944, this patient had an indurated area on the shaft of the penis which showed no necration and disappeared in 5 days.

On 12 July he developed a generalized vesicular rash with a bilateral cervical adenopathy. A Kahn blood test was 4 plus on 15 July. Arsenical treatment was begun with a 0.03-gm. injection of mapharsen on 15 July, followed by 0.06-gm. injections on 17, 19, 21, and 24 July.

Thirty minutes after the last injection the patient felt nauseated but no vomiting occurred at that time. He noticed the appearance of a macular type of rash covering the entire body, associated with a slight pruritus of the lower extremities. Two hours later he vomited for the first time. He reported to the sickbay 9 hours after the injection.

On physical examination the temperature was 105° F., with a rapid, strong pulse of 112, respirations 22, and blood pressure 116/74. The skin was warm, moist, and covered with a generalized maculopapular rash. He showed some mental confusion. No jaundice was noted. The only other positive finding

was a generalized lymphadenopathy with slight tenderness to pressure over the left inguinal nodes. At the time of examination he was given phenobarbital, grains 3, and aspirin, grains ten.

The patient was transferred to a Naval hospital. At the hospital the urine was found to be normal, the blood count within normal limits, the Kahn blood test 4-plus repeatedly, and the spinal fluid Kahn reaction negative, with 7 white blood cells, no increase in globulin, total protein 43.2 milligrams, and the colloidal gold curve 1122210000.

Because of his hyperthermia (105° F.) penicillin was used. He was given 40,000 units every 3 hours for 60 doses intramuscularly for a total of 2,400,000 Oxford units. At the completion of treatment the spinal fluid was entirely normal. The Kahn blood test was 3-plus on 28 August. The patient is to have monthly Kahn blood tests and in 6 months a check spinal fluid survey.

Case 15—1944—This patient reported to the sickbay with a small abrasion just inside the lower lip on the right side. The lesion gradually became slightly larger and button-like. Darkfield findings on 15 and 16 October 1943 were negative. The Kahn blood test was 4-plus. The source of contact was unknown to the patient. The lesion had the typical appearance of a chancre. Cervical lymphadenitis was present. A typical macular rash was noted over the anterior part of the chest and shoulders, apparently the late primary and beginning of the secondary stage.

From 10 October 1943 to 13 July 1944 he received intermittent treatment with 30 injections of mapharsen, a total of 2.34 gm., and from 18 July to 22 August, ten 0.06-gm. injections of mapharsen. Six days after the last injection the patient was admitted with a complaint of rash on the body and stated that he had noticed a rash over the inguinal region for the past week or 10 days. This gradually became worse in spite of local treatment. Irregular areas which were red and weeping in some areas were noted over the chest, neck, upper arms, antecubital spaces, anterior axillary folds, and inguinal region. There was evidence of desquamation in places. Nail scratches were also in evidence.

Arsenic therapy was discontinued. Abundant fluids, bed rest, and calamine lotion frosting continuously, preceded periodically by sodium bicarbonate frosting, were prescribed. The improvement was rapid and gratifying except for one slight exacerbation. Recovery was complete in 17 days.

Case 16—1944.—One month after exposure to infection on 23 December 1943, this patient developed a large ulcerated lesion just posterior to the coronary sulcus on the dorsum of the penis and a small ulcer just lateral to the frenum. It was indurated and covered with a yellowish exudate. Left inguinal adenopathy was present. A darkfield examination showed *Treponema pallidum* on 28 January 1944.

Arsenical treatment was begun with a 0.03-gm. injection of mapharsen on 28 January 1944, followed by 0.06-gm. injections on 2 and 4 February. Six hours after the last injection the patient developed a fever of 102.6° F., with generalized adenopathy and a feeling of general malaise. On 7 February the patient was afebrile, but had a generalized papular rash, most prominent in the area of the thorax and abdomen. There was generalized adenopathy. There were no mucous patches, no lesions on the soles or palms, and no alopecia areata. He was given a 0.03-gm. injection of mapharsen and the fever rose to 105.4° Fahrenheit. The rash became more confluent and angry. A Kahn blood test was 2-plus. Two days later the temperature was 101° F.

in the morning. Injections of BAL were given at 1300 and 1600. Prior to the injections the patient was improving clinically, the rash and fever subsiding.

On the following day the patient stated that he felt better and that there was no headache or weakness. The rash had disappeared almost completely. His temperature was 100° Fahrenheit. Clinically there was no apparent difference in the rate of improvement since the BAL injections. The third injection of BAL was given.

Blood picture

February	RBC	WBC	Hg.	Seg. cells	Lymphocytes	Band forms	Basophils	Juveniles	Mono-cytes
7	4,500,000	13,800	13.5	72	5	17	1	5	—
8	3,800,000	11,000	13.0	52	25	14	1	8	—
10	4,270,000	8,300	13.3	—	—	—	—	—	—
12	4,300,000	7,800	13.2	49	46	4	—	—	1

Two days later the temperature had remained normal for 24 hours, and there were no subjective symptoms. The rash had disappeared. One injection of bismuth in oil was given intramuscularly with no reaction. A fourth injection of BAL was given. The Kahn blood test reaction was 4-plus. The impression was that this patient had been improving prior to the first injection of BAL. After treatment with BAL was started, genuine subjective improvement was noted, but objectively the fever and rash improvement continued at approximately the same rate as noted prior to treatment with BAL. Recovery was complete in 10 days.

Case 17—1944.—This patient was first seen on 12 November 1943, with several small, shallow ulcers on the corona of the penis. These rapidly increased in size and regional adenopathy developed. Sulfonamide powder applied locally had no apparent effect. Darkfield examination showed *Treponema pallidum* on 18 November.

From 18 November 1943 to 1 February 1944 he received 19 injections of mapharsen, a total of 1.12 gm., and from 17 March to 15 May 1944, he received 16 injections, a total of 0.96 gram.

About the sixth week of the first course of the drug, a small moist, macerated lesion appeared between the fourth and fifth toes of the left foot. This appeared to be an epidermophytosis and received intermittent treatment with tincture of merthiolate and 5-percent salicylic acid in 70-percent alcohol. There was some improvement, but the area persistently scaled and there was mild pruritus.

During the third week of the second course, a few small reddish papules appeared on the inner side of the left foot and deep-seated blisters developed. These were opened and treated with 5-percent salicylic acid. A slow spread of the lesions occurred during the following month, and was partially controlled by potassium permanganate baths.

During the eighth week of the second course of drug therapy, erythematous plaques with itching appeared on the dorsa of the fingers and hands. These developed tiny blisters which coalesced and ruptured, leaving raw areas. At the same time the lesions on the left foot rapidly spread and showed independent, erythematous plaques identical with those on the hands. Since the site of the hand involvement was not that of a typical reaction to a fungus infection, arsenical therapy was discontinued. Boric acid and potas-

sium permanganate soaks had no effect, and the eruption spread to involve both forearms and left lower leg. A few small erythematous plaques also appeared on the right foot and leg.

In the eleventh week of the second course, the Kahn blood test was negative and a complete blood count was within normal limits. The patient received sodium hyposulfite, 1 gm. intravenously daily for 5 days. There was immediate improvement which continued after the injections were discontinued. The patient was returned to duty within 12 days after the first injection.

Case 18—1944.—This patient was exposed to infection on 1 October 1943, and developed hard, raised papules on the penis, scrotum, and perineum on 21 October. Darkfield findings and Kahn blood test were negative. In November an ulcer developed on the ventral surface of the penis and healed in about 10 days. A maculopapular rash developed on the chest on 18 December, and spread later to the extremities, abdomen, and neck. A Kahn blood test at this time was 4-plus.

He was given a 0.03-gm. injection of mapharsen on 5 January 1944. Twenty-three hours after the injection he developed an itching, exudative eruption over the upper part of the chest. Two days later there was some spreading of the eruption over the anterior chest and axillae, and by 14 January the patient had developed some secondary pustular lesions over the chest, neck, shoulders, and face. On the next day the lesions had subsided.

On 9 February the patient had developed some new, grouped, pustular, itching lesions following a small test dose of mapharsen (0.0075 gm.). By 20 February these lesions were healing, and there was no itching. By 27 February the original lesions had disappeared. There were some scratch marks and lichenified areas, and these were still present on 21 March. There was some question as to whether the lichenified and large pustular lesions were remaining secondary syphilids or lesions secondary to the arsenical dermatitis.

On 13 April the patient was circumcised and a specimen of skin was taken from the prepuce for biopsy. Microscopically the section showed a regular stratified squamous covering epithelium. There were a few perivascular lymphoid infiltrations in the dermis. No plasma cells were seen. The pathologic diagnosis was chronic dermatitis, nonspecific.

Four days later new vesicles and pustules appeared on the wrists, and biopsy of a forearm lesion showed a normal appearing epidermis. The outer layers of the dermis showed evidence of moderate edema with distention of capillaries in the area. About many of the vessels were sparse infiltrations of lymphoid cells with an occasional polymorphonuclear leukocyte. Rarely a plasma cell was seen. Capillaries in the outer layers of the dermis showed proliferative changes in all wall layers. No infiltration of cells was seen about sweat or sebaceous glands. The impression was toxic dermatitis, nonspecific.

By 25 April these wrist lesions had cleared up, and on 10 May a 0.006-gm. injection of mapharsen was given. There was no itching or other evidence of skin reaction.

On 14 May a biopsy from the lichenified areas on the abdomen was done. On section the dermis showed slight thickening. There were a few infiltrating lymphoid cells which encircled small vessels. The upper dermis appeared to be diffusely edematous. No specific change was seen. The pathologic diagnosis was chronic dermatitis, nonspecific.

No specific treatment was given for the arsenical reaction. Penicillin.

20,000 units every 3 hours, was started on 27 March and continued until 1,200,000 units had been given. This was given as treatment for syphilis as well as for the pustules. The patient also received a 0.006-gm. injection of mapharsen on 8 May, and from this day until 22 June he received 14 injections of mapharsen in ascending doses, increasing by 0.003 gm. each time. There was complete recovery from the reaction in 53 days.

Case 19—1944.—This patient was exposed to infection on 15 February 1944, and on 25 March a penile lesion appeared which became larger and slightly ulcerated. He reported to the sickbay on 3 April at which time he had a shallow ulcerated lesion with indurated edges, and a large rubbery satellite bubo in the left inguinal region. Darkfield findings were positive on 4 April, and Kahn and Kolmer blood tests were positive on 14 April.

The patient was given a 0.03-gm. injection of mapharsen on 4 April which was followed by a temperature of 100° Fahrenheit. This was attributed to tonsillitis. He was afebrile by the third day. He received a 0.06-gm. injection of mapharsen on 7 April and stated that during the night he felt nauseated and had pains in the flanks. He continued to feel ill, with sore throat and pains in his neck and back, and on 11 April he received another 0.06-gm. injection of mapharsen. On 14 April he had a fever of 100° F., and complained of a sore throat. His tonsils were enlarged and inflamed. He was given 0.06-gm. of mapharsen and admitted to the ward. He then developed a fever of 105° F., vomited twice, and complained of a headache, backache, "pains in the kidneys," and nausea.

Physical examination showed an acutely ill man with a fever of 105° F., who was well oriented, but drowsy and uncomfortable. His skin was dry but not scaling. There were no excoriations. There was a diffuse macular, erythematous skin eruption over the entire body. The scleras were injected but not icteric. The tongue and lips were dry and swollen. The patient was thought to be having so-called "ninth-day erythema." He received 2 intravenous injections of 1,000 cc. of 5-percent dextrose in saline. The temperature fell to 103° F.; the urine showed 1-plus albumin and granular casts. Roentgenographs of the chest made with a portable unit showed no gross evidence of a pneumonia infection. The temperature was normal at 2200.

On the following day, however, the temperature began to rise and reached 104° F. by 0400. It was normal at 1600. The rash was much more pronounced and seemed to be morbilliform in character. The patient was coughing up gray sputum and complaining of pain in the anterior part of the chest on taking a deep breath. No rales were heard or felt. By 27 April the patient had been afebrile for the past 9 days and had been up and about the ward. Recovery was complete in 13 days.

Case 20—1944.—A patient reported to the dispensary on 20 August 1944 complaining of joint pains and at that time revealed that he had previously been under treatment for syphilis. The entire story of treatment could not be learned because of language difficulties. Twenty-nine 0.06-gm. injections of mapharsen had been given prior to 20 August. An exfoliative dermatitis covered the entire body. Mapharsen treatment was discontinued. Bismuth treatment, however, caused stomatitis. Antiluetic treatment was therefore discontinued for 1 month.

Case 21—1944.—During routine check of food handlers employed by the Military Government, a specimen of blood was obtained revealing a presumptive positive Kahn and a standard Kahn 4-plus. After 12 injections of

mapharsen the patient reported to the sickbay for routine injection and it was observed that he had developed an exfoliative dermatitis which covered the entire body. Mapharsen therapy was discontinued, and bismuth treatment started. The patient received 9 injections of bismuth, totaling 2.34 gm., after which the presumptive Kahn test was negative, and treatment was discontinued.

NEOARSPHENAMINE

Case 22—1944.—After exposure to infection on 30 April 1944, this patient developed a penile lesion and slight enlargement of the epitrochlear, axillary, and inguinal glands. Darkfield examination showed *Treponema pallidum*.

Arsenical treatment was begun with mapharsen, and after the fifth injection on 16 May, he developed a scarlatiniform rash which persisted for 3 days. Arsenical treatment was discontinued. On 11 July, a second course of mapharsen was attempted with a 0.06-gm. injection which immediately provoked a rise in temperature to 102° F., redness of the skin, and severe chest pains which lasted from 18 to 24 hours. Treatment was discontinued.

A third course began with a 0.3-gm. injection of neoarsphenamine on 11 August with no reaction. A 0.4-gm. injection was given on 15 August with no reaction until the following day, when a small vesicle appeared on the left hand; there was also headache, but no temperature elevation. The course was continued until 11 October, when he received the twenty-first injection. A severe reaction occurred the following day.

The patient was placed on forced fluids and a high carbohydrate diet, and he was given ten 150-milligram injections of 5-percent solution of BAL in peanut oil with 10-percent benzyl benzoate intramuscularly. Four injections at 4-hour intervals on 12 October, and one injection daily thereafter up to and including 18 October were given.

On 13 October the patient presented a profuse scarlatiniform rash involving the arms, chest, back, and legs. The temperature was 101° F., the skin was very red, and there was marked conjunctivitis. The fluid intake was 2,400 cc.; the output 800 cubic centimeters. The following day there was great improvement. The skin color began to fade and there was some scaling along the bridge of the nose and about the face. Except for beginning desquamation, later diagnosed as exfoliative dermatitis, the patient's condition was normal on 19 October. Recovery was considered complete in 8 days.

Case 23—1944.—This patient was being treated for arthritis deformans. He had experienced severe neck pain continuously for 12 months. Two months before arsenical treatment was begun his ankles became painful and swollen. He developed severe pain in his back and intermittent pain of severe character in his wrists, elbows, and shoulders. He lost considerable muscular use of his legs and power of grip in his hands. The middle interphalangeal joints of his fingers showed definite fusiform swelling. Beginning 4 February 1944, when the pain became especially severe in the ankles, he was kept in the sickbay for 8 days. By this time he had been under continuous treatment for infectious arthritis for 7 months, being treated with iodides and salicylates to no avail.

The picture of a definitely progressing atrophic arthritis now developed. Therefore, since his condition was becoming more and more crippling, and all other forms of treatment had not in the slightest checked his downward course, an arsenical was used in an effort to arrest further progress in the infection. As sulfarsphenamine was not available, a course of neoarsphena-

mine was started while the patient was in the sickbay. From 9 February to 4 March he received eight weekly injections of neoarsphenamine, a total of 2.3 gm., and from 17 March to 7 June, eight weekly injections, a total of 4.2 grams. In several weeks he began to improve steadily but slowly, as evidenced by a lessening of his pain, disappearance of the swelling, and an improvement in muscular strength and in the grip of his hands. This improvement continued throughout his treatment.

A third course of arsenical treatment was begun with 0.3-gm. injections of neoarsphenamine on 22 and 27 June and 3 July. Urinalysis before each injection yielded negative findings and there were no forewarning signs of intolerance.

Five days after the last injection he noticed an itching of his lower arms and lower legs. Gradually a dermatitis appeared, and on 10 July this bothered him to the extent that he was admitted to the sickbay. Physical examination was essentially negative except for the skin involvement of his extremities. Several pea-sized vesicles were present in these areas and there was a tendency toward weeping in some places. There was slight edema of the flexor surface of the elbow joint and of the ankles. On this admission the temperature was 100° Fahrenheit.

Three daily injections of sodium thiosulfate, of 0.5 gm., 1 gm., and 1.5 gm. were given in addition to symptomatic treatment and local boric acid wet dressings. There was moderate weeping of the lateral surfaces of both ankles and of both forearms. In the nonweeping areas the eruption was of a vesiculopapular type, with a deep, diffused red base. There was moderate extension of this to above the elbows and to the posterior part of the neck.

He had a chill in the afternoon of 14 July and a temperature elevation to 103° F., together with an extension of the skin involvement to his entire back, thorax, and abdomen. Local treatment with 5-percent sulfanilamide in cold cream, and general supportive treatment consisting of a high protein diet and multiple vitamin tablets, were given. By 16 July there was moderate exfoliation of both forearms and legs, and slight exfoliation of the back. Blood counts taken during this admission revealed erythrocytes varying from 4,560,000 to 4,800,000, with 14 gm. of hemoglobin, and leukocytes varying from 9,160 to 9,700. The differential revealed from 2 percent eosinophils in the beginning to 11 percent.

The patient's temperature continued to be septic, but by 23 July the reddish discoloration of the skin was gradually fading, although there was still some erythema. Desquamation was complete. There were a few small pustules on the forearms and upper legs, and moderate edema of the ankles. By 26 July he was afebrile, edema of the ankles had subsided, and the erythema had diminished considerably. On 29 July the erythrocyte count was 3,800,000, the hemoglobin concentration 85 percent, and the leukocyte count 11,400 with a normal differential, except for 8 percent eosinophils. The following day the patient developed a small pustular rash on his chin and neck and on 3 August there was recrudescence of mild vesicular weeping of the ankles, but all other areas were clearing well; very little erythema remained. On 10 August the patient continued to be afebrile and to feel good. He had a slight vesicular eruption on the bottom of his right foot and a slight residual erythema on the outer sides of his ankles which subsided by 18 August. The patient was discharged to duty entirely well after 36 days.

Case 24—1944.—After exposure to infection on 15 June 1944, this patient developed a chancre on the prepuce of the penis and moderate inguinal adeno-

pathy. A darkfield examination showed *Treponema pallidum*. A Kahn blood test was negative.

From 24 July to 21 September he received 6 injections of mapharsen, a total of 0.33 gm., and 13 injections of neoarsphenamine, a total of 7.35 grams. Two days before the last injection the patient was admitted to the sick list complaining of pain in both feet. Physical examination revealed a slight symmetrical swelling of both feet with a maculopapular rash over both legs. Urinalysis showed 4-plus sugar but no albumin. Daily urinalyses thereafter showed a gradual decrease in sugar content until the urine became normal.

Treatment consisted of warm boric acid dressings to the skin, sodium thiosulfate, 1 gm. daily for 6 days, multivitamins three times a day, and 1 cc. of liver extract intramuscularly every 2 days. BAL ointment was used for 2 days but caused discomfort and was discontinued. The patient was placed in a heat cradle during and following exfoliation of the skin. Recovery was complete in 32 days.

Case 25—1944.—After exposure to infection on 23 January 1944, this patient developed an initial lesion on the shaft of the penis. A darkfield examination showed *Treponema pallidum*. From 16 February to 26 February he received three 0.06-gm. injections of mapharsen and from 3 March to 17 April thirteen 0.6-gm. injections of neoarsphenamine.

Itching of the skin was first noticed on 7 April. A rash followed during the next few days. At about the same time the rash developed, diarrhea began, associated with abdominal cramps, and lasted for about a week. Treatment with mapharsen was discontinued on 17 April. Two days after treatment was discontinued, and about 12 days after onset of the itching, the patient was confined to bed. The eruption was fullblown, and sore throat and slight fever were present. During the last week desquamation developed. The entire body was covered by an exfoliative dermatitis. No medication was being given at the time and no food is believed to have been at fault. No other allergic manifestations were noted. The leukocyte count was 13,550 on 22 May. There was much puffiness about the eyes at this time and there was a marked conjunctivitis.

Treatment consisted of boric acid irrigations of the eyes, applications of 1-percent phenol locally, administration of 1 unit of plasma and of 1,000 cc. of 5-percent dextrose. Five-percent nupercaine in 10-percent U.S.P. boric acid was also applied locally, and x-ray therapy was administered to the face. Penicillin was given, a total of 100,000 units intravenously, and 100,000 units intramuscularly, in doses of 15,000 every 3 hours; recovery was complete in 29 days.

Case 26—1944.—This patient was exposed to infection on 1 March 1944 and stated that he noticed a sore on the penis 10 days later. He did not report to the sickbay until 25 March. Darkfield findings were negative, but a Kahn blood test was 4-plus.

From 29 March to 5 May he received 9 injections of neoarsphenamine, a total of 5.4 gm., and 5 injections of bismuth subsalicylate, a total of 1.30 grams. The day following the last injection of neoarsphenamine, small lumps appeared on the back. They itched considerably and spread rapidly over the entire body. There was also an extensive maculopapular rash over the entire surface of the extremities, neck, and back. In the folds of the arms, and behind the knees and neck these were coalesced to a scaly, crustaceous lesion with extensive weeping. Over the body the lesions were single, from 2 to 4

mm. in size, and grayish white. Many were vesiculated and ruptured on pressure.

Urinalysis showed the urine to be loaded with white blood cells. A complete blood count showed a hemoglobin concentration of 97, 5,110,000 erythrocytes, and 16,600 leukocytes, with 59 percent segmented cells, 12 percent lymphocytes, 4 percent mononuclears, 20 percent eosinophils, and 5 percent band forms. Treatment consisted of two intravenous injections of sodium thiosulfate, sulfadiazine, 1 gm. every 4 hours, and boric acid compresses. The time of recovery was not reported.

COMMENT

In 1944, medical officers of the Navy administered a total of 396,144 doses of arsenicals and reported the occurrence of 80 untoward reactions. Of these toxic reactions, 26 were cases of arsenical dermatitis, a ratio of one to every 15,236 doses. Of interest in connection with a review of the causes of arsenical dermatitis are the instances in which premonitory signs were noted. They tend to indicate the necessity for careful examination and questioning of each patient before administering an arsenical.

For example, in case 14, after five injections of mapharsen the patient felt nauseated and noticed the appearance of a macular type rash covering the entire body, with a slight pruritus of the lower extremities. The temperature on examination was 105° Fahrenheit. In case 17, about the sixth week of the first course of mapharsen, small, moist, macerated lesions appeared between the fourth and fifth toes of the left foot. The erythematous plaque involvement spread to both arms and the left lower leg, with a few plaques appearing on the right foot and leg. The involvement was not a typical fungus infection. In case 19, the patient had a febrile reaction from the first injection of mapharsen, and upon continuance of the therapy, a diffuse macular erythematous rash developed over the entire body.

VENEREAL DISEASE CONTACT INVESTIGATION IN THE U. S. NAVY, THIRD QUARTER 1944

EFFICIENCY OF NAVY CONTACT-EDUCATION
INTERVIEWS AND RESULTS OF CIVILIAN
HEALTH DEPARTMENT INVESTIGATION

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The joint venereal disease control effort of the armed services and civilian authorities has developed during the war years along four major lines: (a) Diagnosis and treatment (including prophylaxis); (b) education; (c) repression of prostitution; and (d) contact investigation. This latter element has come into increasing prominence; in the development of the control program the epidemiologic concept has been basic.

Recognition has been given to the fact that each case of venereal disease stems from another case, and that the location not only of the sources of infection, but also of all persons exposed to any case, comprises a direct, productive, and indispensable control mechanism. "Contact investigation" has been the term applied to the entire epidemiologic operation dealing with contacts. In the Navy, contact investigation is considered as comprising:

1. *The contact-education interview.*—This is a serious conversation between the patient and the medical officer or hospital corpsmen interviewer. Its purpose is educational in that the patient's diagnosis and treatment regimen are clarified, his store of venereal disease information is strengthened and corrected, and efforts are made to reorientate him away from further infections. The other purpose of the interview naturally is accurate identification of *all* persons with whom the patient has had sex relations during the incubation period of his infection and up to the time of the interview.

2. *Contact reporting* is the second element of contact investigation. Its vehicle is Form Navmed 171, Venereal Disease Contact Report (fig. 1). The system of routing the five copies of the form is explained, simply but in detail, on the reverse of the form. Navmed 171's primary function is to identify contacts adequately; its secondary purposes are statistical and administrative. The basic principle in contact reporting is to transmit completed forms to proper civilian health authorities with all possible speed.

3. *Contact location* is a function of civilian health departments. Data furnished through Navmed 171 is used by field workers to locate alleged contacts and to persuade them to be examined.

4. *Contact disposition* is also a civilian operation. It involves the medical examination of the contact, establishment of the diagnosis, and the placing under treatment if necessary—plus reporting the results of investigation back to the Navy by means of Navmed 171.

THE CHAIN OF INFECTION

Contact investigation relates to the venereal disease control effort in several basic respects. It breaks the chain of infection by leading to the establishment of a "chemical quarantine" of infectious cases. This has the effect of reducing known sources of infection of Naval personnel and of highlighting the implications of venereal disease and the importance of its control.

From the point of view of civilian public health, contact investigation tends to bring a larger proportion of early, infectious cases under treatment than do other devices such as blood test dragnets, premarital and prenatal examinations, etc., thus lowering the reservoir of infection. It tends also to focus attention on those locations where encounters and exposures most frequently occur, thus providing a factual guide for social protection and law enforcement action.

For both Navy Medical Department and for civilian authorities, contact investigation analyses (such as follow) provide a continuing and current picture of the nature of the problem. They direct attention to points where emphasis is needed, and aid directly and concretely in the efficient administration of the control program.

THE NAVY SYSTEM

The current Navy Medical Department system of contact investigation represents a refinement and a unification of a heterogeneous variety of forms and processes which had been placed into effect by specific stations and District medical offices over a

period of years. Form Navmed 171 was developed after an extended survey and analysis not only of forms in use by Navy activities, but also those employed by the Medical Department of the Army, the U. S. Public Health Service, and State and local health departments. The routing system—upon the efficient and rapid operation of which so much depends—was evolved after careful study of existing systems, extended consultation with the U. S. Public Health Service, and review by the Conference of State and Territorial Health Officers.

By Bureau directive the Navmed 171 contact investigations system was set in motion on 1 July 1944. The following analysis covers the 3-month period July-September 1944, and is the first of a series of quarterly reports. The material deals with four major elements: (1) Distribution of contacts in terms of Naval Districts reporting and the geographic place of exposure; (2) evaluation of Navy interviewing efficiency; (3) results of investigation by civilian health departments; and (4) the general characteristics of the contacts identified. Data are presented in some detail for exposures occurring in the United States and possessions, and in general for foreign exposures.

DISTRIBUTION OF CONTACTS

Table 1 (columns 3 and 4) indicates the distribution of reported contacts in terms of the place of reporting (abbreviated "PORe"), i.e., the place where the patient was diagnosed and interviewed. Table 3 (columns 2 and 3) reports the distribution of places of exposure (abbreviated "POEx") by Naval District areas. More Navmed 171s originated in East Coast Districts (1, 3, 4, 5, 6, Potomac and Severn River Commands) than on the West Coast (Districts 11, 12, 13). The relative percentages were 35.4 and 27.7. Similarly more reported exposures took place on the East Coast (39.8 percent) than on the West Coast (27.6 percent). However the State of California alone accounted for 22 percent of all reported exposures in the United States and Territories, being followed by Virginia (8.3 percent), New York (8.1 percent), Florida (5 percent), and Texas (4.5 percent).

Column 4 of table 3 shows the relationships between the PORE District and the POEx District area. Percentages are given across the table and indicate the proportion of exposures occurring in a given District (column 1) in terms of the District in which the interview was held (column 4). An average of 42 percent of exposures occurring in a District are reported by that District. This figure is higher for the West Coast (63 percent) than for the East Coast (36 percent).

TABLE 1.—NAVY VENEREAL DISEASE CONTACTS REPORTED FOR THIRD QUARTER 1944
Exposures in United States and Territories
reported by Naval districts and ships
with evaluation of identification data and results of civilian investigation
for all venereal disease

Navy reporting and interviewing efficiency				Results of civilian health department investigation (Percent of contacts (col. 3) for each evaluation class)					
Place of reporting (PORe) Naval district or ship	Interviewing evaluation classes	Contacts reported		No report returned to Navy	No investigation; data insufficient	Contact not located	Contacts located		
		Number	Percent by evaluation classes				Total (including other*)	Disposition**	
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10
First.....	A	244	17.4	41.4	0.8	12.7	45.1	16.4	21.7
	B	399	28.5	26.8	9.8	22.1	41.4	16.0	20.3
	C	757	54.1	15.7	55.4	21.4	7.5	2.2	3.8
	Total...	1,400	100.0	23.4	32.9	20.1	23.7	8.6	11.6
Third.....	A	250	14.5	27.2	1.6	17.6	53.6	2.6	19.6
	B	524	30.4	28.6	9.7	29.8	31.9	14.1	13.9
	C	950	55.1	26.1	51.8	17.9	4.2	2.0	1.6
	Total...	1,724	100.0	27.0	31.7	21.5	19.8	9.2	7.9
Fourth.....	A	77	17.0	32.5	1.3	19.5	46.8	2.1	23.4
	B	123	27.2	35.8	6.5	20.3	37.4	17.9	15.4
	C	253	55.8	35.2	51.4	8.7	4.7	15.8	1.6
	Total...	453	100.0	34.9	30.7	13.7	20.8	9.3	9.1
Fifth.....	A	567	16.0	34.4	2.5	17.3	45.9	17.3	21.7
	B	1,004	28.4	32.2	7.6	29.6	30.7	9.8	15.6
	C	1,964	55.6	21.9	50.1	19.9	8.1	2.5	3.6
	Total...	3,535	100.0	26.8	30.4	22.2	20.6	7.0	9.9
Sixth.....	A	94	15.2	27.7		20.2	52.1	22.3	20.2
	B	193	31.3	26.4	5.2	26.9	41.5	16.6	15.5
	C	330	53.5	21.8	40.3	25.2	12.7	3.9	6.7
	Total...	617	100.0	24.1	23.2	25.0	27.7	10.7	11.5
Seventh.....	A	81	13.4	24.7	1.2	3.7	70.4	24.7	38.3
	B	145	24.0	24.8	5.5	27.6	42.1	15.9	17.2
	C	377	62.5	17.0	48.0	24.1	10.9	5.0	5.0
	Total...	603	99.9	19.9	31.5	22.2	26.4	10.1	12.4
Eighth.....	A	260	11.9	32.7	1.2	15.4	50.8	16.2	26.9
	B	566	25.8	25.1	4.1	27.9	42.9	12.9	22.8
	C	1,364	62.3	20.8	33.9	31.5	13.8	3.6	7.8
	Total...	2,190	100.0	23.3	22.3	28.7	25.7	7.5	13.9
Ninth.....	A	287	15.8	30.3	0.7	22.3	46.7	18.1	21.3
	B	502	27.6	32.5	4.0	25.7	37.8	14.3	18.5
	C	1,030	56.6	21.8	36.9	30.3	11.0	3.8	6.1
	Total...	1,819	100.0	26.1	22.1	27.8	24.0	9.0	11.9
Eleventh.....	A	484	15.8	26.7	2.3	15.5	55.6	28.5	23.3
	B	827	27.1	27.2	8.8	27.6	36.4	15.4	16.7
	C	1,744	57.1	16.0	56.2	21.7	6.1	22.4	29.2
	Total...	3,055	100.0	20.7	34.8	22.3	22.1	10.0	9.9
Twelfth.....	A	205	8.8	23.4	1.0	19.5	56.1	18.0	33.2
	B	574	24.6	14.6	5.2	36.8	43.4	16.4	19.7
	C	1,556	66.6	9.4	57.9	24.7	8.0	2.6	3.5
	Total...	2,335	100.0	11.9	40.0	27.2	20.9	7.3	10.1
Thirteenth....	A	163	13.7	43.6	3.1	12.2	41.1	15.3	18.4
	B	329	27.7	38.0	9.4	19.2	33.4	8.4	15.5
	C	694	58.5	25.4	39.3	26.7	8.6	3.2	2.9
	Total...	1,186	99.9	31.3	26.1	22.6	20.0	7.6	8.5

* Includes percentages under "Disposition" (cols. 9, 10), plus contacts infected but under treatment prior to investigation, contacts located but not examined, and contacts found infected but not placed under treatment.

** Disposition percentages are included in "Total Contacts Located" (col. 8).

TABLE 1.—Continued

Navy reporting and interviewing efficiency				Results of civilian health department investigation (Percent of contacts (col. 3) for each evaluation class)					
Place of reporting (PORe) Naval district or ship	Inter-viewing evaluation classes	Contacts reported		No report returned to Navy	No investigation; data insufficient	Contact not located	Contacts located		
		Number	Percent by evaluation classes				Total (including other*)	Disposition**	
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10
Potomac River.	A	125	18.4	20.8	2.4	13.6	63.2	24.8	29.6
	B	182	26.8	30.2	6.0	24.2	39.6	13.2	21.4
	C	372	54.8	16.1	52.4	21.5	10.0	3.5	3.8
Total...		679	100.0	20.8	30.8	20.7	27.7	10.0	13.3
Seyvern River...	A	2	4.1			50.0	50.0		
	B	7	14.3	14.3		14.3	71.4	28.6	42.9
	C	40	81.6	12.5	67.5	17.5	2.5	2.5	
Total...		49	100.0	12.2	55.1	18.4	14.3	6.1	6.1
Tenth.....	A	22	37.3			9.1	90.9	18.2	27.3
	B	13	22.0	7.7		30.8	61.5		7.7
	C	24	40.7		25.0	33.3	41.7		12.5
Total...		59	100.0	1.7	10.2	23.7	64.4	6.7	16.9
Fourteenth....	A	36	17.3	19.4	2.8	16.7	61.1	36.1	11.1
	B	51	24.5	31.4	13.7	11.8	43.1	31.4	2.0
	C	121	58.2	15.7	48.7	11.6	24.0	17.4	4.1
Total...		208	100.0	20.2	32.2	12.5	35.1	24.0	4.8
Fifteenth.....	A	3	11.5			100.0			
	B	4	15.4		25.0	50.0	25.0		
	C	19	73.1	26.3	52.6	15.8	5.3	5.3	
Total...		26	100.0	19.2	42.3	30.8	7.7	3.8	
Seventeenth....	A	1	7.7			100.0			
	B	2	15.4	50.0		50.0			
	C	10	76.9	40.0	40.0	20.0			
Total...		13	100.0	38.4	30.8	30.8			
Ships.....	A	393	10.5	30.0	2.0	24.0	44.0	19.3	19.6
	B	928	24.8	28.9	11.4	27.8	31.9	11.5	14.8
	C	2,425	64.7	18.6	56.8	18.5	6.1	2.6	2.8
Total...		3,746	100.0	22.3	39.8	21.4	16.5	6.6	7.5
Non-districts...	A	10	12.8	30.0	20.0	10.0	40.0		30.0
	B	14	17.9	50.0	7.2	21.4	21.4		14.3
	C	54	69.2	27.8	50.0	9.2	13.0		7.4
Total...		78	99.9	32.1	38.5	11.5	17.9		11.5
Not stated....	A	12	12.9	8.3	8.3	16.7	66.7	33.3	16.7
	B	20	21.5	10.0	55.0	35.0		20.0	25.0
	C	61	65.6	11.5	54.1	29.5	4.9	1.6	1.6
Total...		93	100.0	10.7	36.6	29.0	23.7	9.7	8.6
Total.....	A	3,316	13.9	30.5	1.8	17.3	50.4	20.5	23.0
	B	6,407	26.8	28.1	7.7	27.7	36.5	13.7	17.1
	C	14,145	59.3	19.1	50.0	22.6	8.3	2.9	3.9
Total...		23,868	100.0	23.1	32.0	23.2	21.7	8.2	10.1

* Includes percentages under "Disposition" (cols. 9, 10), plus contacts infected but under treatment prior to investigation, contacts located but not examined, and contacts found infected but not placed under treatment.

** Disposition percentages are included in "Total Contacts Located" (col. 8).

The worth of contact investigation to the Navy is dependent upon (1) contact-education interviewing efficiency, and (2) the rapidity and accuracy of contact reporting. Poor interviewing can be helped little by efficient reporting; poor reporting vitiates good interviewing.

An objective measurement of the completeness and value of the information entered upon Navmed 171 has been attempted. The evaluation has been in terms of the adequacy of information for the location of the contact identified. Preliminary statistical analysis of a representative sample of 1,000 reports indicated that the degree of completeness of the three items "alleged contact—name or nickname, address, employment type and address" correlated highly with the completeness of all other identifying data. It was determined, therefore, to consider this group of three items as representative and to base an evaluation scale upon them.

The evaluation scale was constructed by assigning quantitative values to each item. The "name or nickname" item was coded as follows: No information, 0; first name, 1 point; nickname, 2; full name, 3. "Alleged contact—address" scored as follows: No information, 0; city only, 1; street name and city, 2; number, street, and city, or telephone number, 3. Under "employment—type and address" the evaluation was as follows: No information, 0; city or type, 1; street and city, 2; number, street, and city, or exact name of establishment and city, or unemployed, 3.

These values were specially assigned and totaled for each Form Navmed 171, the maximum in each case being 9 points. Based on a distribution curve for the 1,000 samples, and drawing upon practical experience, a three-class grouping of ratings was devised. Evaluation class "A" includes only ratings of 9 and 8 points, i.e., full credit information for all three items, or full credit on two and 2-point on one. For practical purposes this means full name and address, and, if the contact is employed, full data on that score. Evaluation class "B" includes the 7-through 5-point group. This is information which may reasonably be considered adequate for location, especially considering the fact that these items are supported by place of encounter and exposure data. The remainder of the ratings (4- through zero-points) fall into class "C" and are considered generally inadequate for location purposes. These reports may, of course, prove of value for social protection and law enforcement purposes, in that places where contacts and exposures are taking place are identified. Occasionally reports which score in this low class include apparently incidental information which is, however, specific for the trained investigator who is familiar with his locality.

Table 1 (columns 2, 3, and 4) presents this interviewing evaluation for each Naval District. Table 2 summarizes the same data for all exposures in the United States and possessions. Of all the interviews represented by Form Navmed 171, 13.9 percent were

TABLE 2.—NAVY VENEREAL DISEASE CONTACT REPORTS FOR THIRD QUARTER 1944
Total exposures in the United States and Territories
with evaluation of identification data and results of civilian investigation
for all venereal disease

Navy reporting and interviewing efficiency				Results of civilian health department investigation (Percent of contacts (col. 3) for each evaluation class)					
Place of reporting (PORe) Naval district or ship	Inter-viewing evaluation classes	Contacts reported		No report re- turned to Navy	No investi- gation; data insuffi- cient	Contact not located	Contacts located		
		Number	Percent by eval- uation classes				Total (in- cluding other*)	Disposition**	
								Not infected	Under treat- ment result of investi- gation
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10
Total, all ex- posures.	A	3,316	13.9	30.5	1.8	17.3	50.4	20.5	23.0
	B	6,407	26.8	28.1	7.7	27.7	36.5	13.7	17.1
	C	14,145	59.3	19.1	50.0	22.6	8.3	2.9	3.9
Total...		23,868	100.0	23.1	32.0	23.2	21.7	8.2	10.1

* Includes percentages under "Disposition" (cols. 9, 10), plus contacts infected but under treatment prior to investigation, contacts located but not examined, and contacts found infected but not placed under treatment.

** Disposition percentages are included in "Total Contacts Located" (col. 8).

scored in Class A and 26.8 percent in Class B. Broadly speaking, therefore, 40 percent of all reports were adequate, and 60 percent inadequate. District by district there is relatively little deviation from the mean. Reports from an increasing number of Naval activities as well as civilian experience indicates that this unfavorable picture can be altered by energetic application of basic principles of interviewing, plus understanding and interest in the processes involved in this important aspect of venereal disease control.

RESULTS OF CIVILIAN INVESTIGATION

In columns 5 through 10, table 1 presents a broad analysis of the results of civilian health department investigation of Navy contact reports in terms of the evaluation classes. Twenty-three percent of all reports failed to be returned to the originating station or Bumed by 31 December 1944. Health departments considered 32 percent to be insufficient to warrant any investigation. It is to be noted that half of the Class C reports were so considered, but less than 2 percent of the Class A.

The contact was not located in 23 percent of all cases. Data not presented in this table indicate that the most common reason for failure to locate was insufficient information (46 percent of the not-located group). In 12 percent of the not-located group the contact was reported to have moved. Altogether, health depart-

TABLE 3.—NAVY VENEREAL DISEASE
Exposures in United
Relationships between places of exposure and

Place of Exposure (POEx) Naval district	Contacts reported		Place of reporting (PORe)—Naval							
	Number	Per-cent	First	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth
Col. 1	Col. 2	Col. 3								
First.....	1,394	5.8	<u>58.0</u>	3.8	0.4	3.4	0.2	0.2	0.6	0.4
Third.....	2,332	9.8	7.4	<u>44.3</u>	3.6	7.8	0.8	0.9	1.1	2.0
Fourth.....	890	3.7	5.1	13.7	<u>26.1</u>	16.7	1.2	0.6	1.8	5.2
Fifth.....	2,797	11.7	3.0	5.1	1.6	<u>51.6</u>	1.5	1.4	2.0	3.0
Sixth.....	1,441	6.0	1.9	4.6	0.7	<u>38.2</u>	24.8	3.7	4.6	5.5
Seventh.....	571	2.4	3.0	2.5	0.2	9.5	6.5	<u>54.6</u>	4.9	3.7
Eighth.....	3,657	15.3	1.9	2.1	0.5	15.6	1.8	2.3	<u>48.3</u>	6.2
Ninth.....	3,079	12.9	3.2	5.4	1.1	10.3	1.7	1.9	5.2	<u>39.6</u>
Eleventh.....	3,100	13.0	0.5	0.2	0.1	0.8	0.3	0.2	0.5	0.8
Twelfth.....	2,250	9.4	1.1	0.4	0.3	0.9	0.2	0.1	0.6	1.0
Thirteenth.....	1,231	5.2	0.7	0.2	0.2	0.6	0.5		0.6	1.2
Potomac River..	672	2.8	4.1	3.7	1.3	22.3	0.9	1.2	1.9	2.1
Severn River...	6	0.0			16.7	<u>50.0</u>				
Tenth.....	122	0.5	1.6	1.6	1.6	4.1	2.5	3.3	4.9	
Fourteenth.....	203	0.9				1.0	0.5			
Fifteenth.....	16	0.1		6.2					6.2	
Seventeenth.....	9	0.0								
Not stated.....	76	0.3	1.3	1.3		13.2	2.6	3.9	6.6	14.5
Denies exposure.	22	0.1		18.2		4.5	4.5	4.5		9.1
Total number contacts....	23,868	99.9	1,400	1,724	453	3,535	617	603	2,190	1,819
Percent of total contacts.....	.....	100.0	5.9	7.2	1.9	14.8	2.6	2.5	9.2	7.6

*Percent totals across.

Underlined percentages indicate where the greatest number of

ments located 21.7 out of every 100 contact reports submitted by the Navy. Of the total contacts located, 59.9 percent were found to be infected, 37.9 percent not infected, and 2.2 percent were not examined. Further breaking down the infected contacts reveals that of those contacts found, only 22.4 percent were already known to be infected, and 77.6 percent were previously unknown cases.

Stated otherwise, medical examination revealed that 8.2 out of every 100 contacts reported upon were not infected, and that 10.1 percent were infected and brought under treatment as a result of this contact investigation operation. This latter figure—which

CONTACTS REPORTED FOR THIRD QUARTER 1944
States and Territories
places of reporting, for all venereal disease

District or ship—percent of contacts (col. 2) for POEx District*

Eleventh	Twelfth	Thirteenth	Potomac River	Severn River	Tenth	Fourteenth	Fifteenth	Seventeenth	Ships	Non-districts	Not stated
Col. 4											
1.1	1.3	0.1	0.8	0.1		0.1			28.5	0.5	0.5
1.5	1.7	0.6	1.8	0.2		0.2	0.3		24.6	0.6	0.6
3.1	2.8	0.8	2.5				0.2		19.4	0.1	0.7
1.2	2.0	0.5	4.3	1.0		0.3	0.1	0.0	20.5	0.4	0.5
3.9	3.1	1.5	1.4	0.1		0.5			4.4	0.4	0.8
1.8	2.1	0.4	0.4			0.4	0.4	0.2	8.8	0.5	0.5
7.0	5.4	2.4	0.7	0.1		0.2	0.1	0.1	4.9	0.2	0.2
8.1	8.2	4.0	2.2	0.0		0.4	0.3		7.7	0.2	0.4
65.2	8.4	1.3	0.2			1.5		0.0	19.9	0.1	0.3
11.5	59.5	2.4	0.1		0.0	1.1			20.4	0.2	0.2
4.4	4.3	65.6	0.2			0.2		0.4	20.4	0.1	0.2
1.6	2.5	1.6	50.4	1.2			0.1		4.6	0.1	0.1
	16.7		16.7								
0.8			2.5		47.5				15.6	9.8	4.1
2.5	3.4	1.5				43.8			47.3		
6.2	12.5					6.2			62.5		
		22.2						33.3	44.4		
18.4	7.9	2.6	17.1							10.5	
27.3	9.1	4.5				4.5			9.1		4.5
3,055	2,335	1,186	679	49	59	208	26	13	3,746	78	93
12.8	9.8	5.0	2.8	0.2	0.2	0.9	0.1	0.1	15.7	0.3	0.4

exposures for a given District were reported.

Blanks indicate no contacts reported.

might be termed the "case finding index"—represents in the final analysis the value of the contact investigation. In short, during the third quarter of 1944, Navy contact investigation operations—despite the low level of interviewing efficiency—brought to light some 2,400 heretofore unknown cases of venereal disease, with the result that they were removed as further menaces to the health of the Navy (and Army and civilian) personnel.

OVERSEAS REPORTING AND FOREIGN EXPOSURES

Table 3 indicates the proportion of exposures which occurred in the United States and possessions, and which were reported by

ships and overseas stations. Ships accounted for a larger percentage (15.7) of domestic exposures than any single District. Ships likewise accounted for almost half of all exposures which took place in foreign areas. Overseas stations and districts each reported about one-fourth. Foreign PORE were, in order of frequency, South America (primarily Brazil), Europe (predominantly Italy), and Australia.

For United States exposures, interviewing efficiency among forces afloat was, on the average, somewhat below District levels as indicated by table 1. As might be expected, foreign-exposure evaluations were considerably lower. Class A was 4 percent as contrasted to 13.9 percent for United States exposures; Class B 17.6 as compared to 26.8; and Class C, 78.4 and 59.3 percent. The case-finding index was 3.8 percent. However 45 percent of the Class A foreign reports were located and 15 percent were found infected and placed under treatment. These figures compare favorably with comparable United States percentages of 50 and 23 respectively.

GENERAL CHARACTERISTICS OF CONTACTS

In the United States and its possessions the "pick-up, no fee" category is dominant and accounts for 67 percent of all contacts. Only 23 percent of foreign contacts are so classified. "Friend" contacts total 17 percent in the United States and 3 percent overseas. Prostitutes were named 6.5 times out of each 100 domestic contacts, but 62.5 out of each 100 foreign. Where "fees" were paid to the contact or her agent in the United States and possessions, they averaged \$4.17; overseas, however, they averaged \$2.28. Exclusive of fees, "costs" in the form of expenditures for food, drink, gifts, etc., in the United States (when stated) averaged \$6.12 as compared with \$4.04 for foreign contacts.

The gonorrhea-syphilis ratio for contacts located and diagnosed with a single infection is roughly 8:1. Of all contact cases 89 percent had gonorrhea and 16 percent had syphilis. Almost 6 percent of the contacts had multiple infections. Prophylaxis usage was as follows:

	<i>U. S. and Possessions (Percent)</i>	<i>Foreign (Percent)</i>
No prophylaxis	63	32
Condom only	15	16
Station only	3	8
Navy tube only.....	9	17
Combination	3	21
Not stated, condom broke, or other.....	7	6

In considering the above data relative to disease and prophylaxis it must be kept in mind that contact reports and not case reports are involved. The number of contact reports does not equal, but rather exceeds to a certain degree, the number of cases.

SUMMARY

1. The significance of contact investigation operations in venereal disease control is indicated, and its components described.

2. The general plan of Navy contact investigation utilizing Form Navmed 171 is outlined.

3. A general analysis of the first 3-month experience with the Navmed 171 system is presented, with data as to distribution of contacts, evaluations of interviewing efficiency, results of civilian health department investigations, overseas reporting and foreign exposures, and general characteristics of contacts.

CONCLUSIONS

The Navmed 171 system of contact investigation may be considered to be off to a fair start in light of the case-finding index of ten. Some 2,400 heretofore unknown cases of venereal disease have been brought under medical treatment in 3 months as a result of this system, despite the fact that Navy interviewing efficiency is at a low level. That level can be raised by the development of a better understanding of the functions of contact investigation in general and of the contact-education interview in particular, and by application of more interest and energy all along the line. With better interviewing will come a higher case-finding index and more efficient venereal disease control.

STATISTICS

HEALTH OF THE NAVY

The statistics (annual rates per 1,000 average strength) appearing in this summary were compiled from data contained in monthly reports of communicable diseases received in the Bureau of Medicine and Surgery for the months of January, February, and March 1940-1945:

ENTIRE NAVY

Year	All causes	All diseases	Injuries and poisonings	Communicable diseases		Venereal diseases
				A	B	
1940.....	548	499	49	21	206	90
1941.....	636	591	45	87	254	62
1942.....	566	519	47	67	223	41
1943.....	577	536	41	78	243	28
1944.....	512	471	41	49	185	26
1945.....	403	359	43	36	126	26

FORCES ASHORE

1940.....	626	583	43	26	300	49
1941.....	805	759	46	140	370	42
1942.....	615	569	46	83	251	26
1943.....	619	580	39	92	278	21
1944.....	550	512	38	59	211	23
1945.....	446	414	33	50	152	28

FORCES AFLOAT

1940.....	493	439	54	17	139	119
1941.....	502	458	44	46	163	78
1942.....	478	431	48	39	175	67
1943.....	425	375	49	24	119	54
1944.....	383	332	51	16	97	36
1945.....	313	248	65	7	71	21

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UNITED STATES NAVAL MEDICAL BULLETIN

PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY

ME 45

NUMBER 5



NOVEMBER 1945

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

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COVER PHOTOGRAPH

Old Glory fluttering gracefully in the breeze, silent guns pointing skyward, fighter planes at ease on a quiet flight deck, gentle clouds and tranquil Pacific waters, ruffled only by the wake of a great ship in motion—all blend into a symbol of the sea war that has been fought and the peace that has followed. The view is aboard an Essex-class aircraft carrier, one of the many heroes in the defeat of Japan.

—Official U. S. Navy Photo.

VOL. 45

NOVEMBER 1945

NO. 5

UNITED STATES
NAVAL
MEDICAL
BULLETIN



MONTHLY

DIVISION OF PUBLICATIONS
BUREAU OF MEDICINE AND SURGERY

Compiled and published under the authority of
Naval Appropriation Act for fiscal year 1946,
Public Law No. 62, approved May 29, 1945

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1945

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
See page II for prices

NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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Volume 27, 1929, No. 4.

Volume 28, 1930, No. 1.

Volume 31, 1933, No. 3.

Volume 42, 1944, No. 2.

SUBSCRIPTION PRICE OF THE BULLETIN

Subscriptions should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Yearly subscription, \$4; foreign subscription, \$5.

Single number, domestic, 35 cents; foreign, 45 cents, which includes foreign postage.

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

ROBERT C. RANDELL, *Editor,*
Commander, Medical Corps,
United States Naval Reserve, Retired.

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U. S. NAVAL MEDICAL BULLETIN

VOL. 45

NOVEMBER 1945

No. 5

SPECIAL ARTICLES

WAR WOUNDS OF THE LIPS AND CHEEKS

GEORGE V. WEBSTER

Lieutenant Commander (MC) U.S.N.R.

Plastic repair of disfiguring wounds about the lips and cheeks requires experienced judgment in the selection and employment of proper methods of surgical reconstruction. Nowhere in the abundant literature on plastic surgical procedures is there a more confusing array of diagrams and descriptions than in the bizarre operations designed to relieve these destructive lesions. Most of the archaic drawings, which have been copied from textbook to textbook, or the unconvincing photographs of cadaver demonstrations, leave the reader with awesome fear and insecurity regarding end results. Such fears are justified, for most of the suggested incisions exhibit complete disregard for blood supply to flaps, for additional scarring of the face, and for the all-important branches of the seventh cranial nerve. Attempts to execute most of them would result in disappointing exaggeration of the disfigurement presented by the original condition.

There are a number of successful operative procedures which are commonly used by plastic surgeons, but a majority of these operations have been developed as a necessary sequel to surgery for cancer of the face and mouth. Such patients are in the older age groups and the surgeon finds that the elastic, almost redundant tissues of the aged yield readily to extensive shifts and stretching, as required, and heal kindly with a minimum scar. Thus it is possible to utilize local tissues for repair without distortion of the outline of a mouth or nose or the production of ectropion. Such use of tissue from the immediate vicinity is always the method of choice where possible, for the color and tex-

ture of local tissue most perfectly simulate that which has been lost.

Unfortunately in the young man of military age, the youthful turgor and relative inelasticity of the skin and subcutaneous tissues narrow the choice of possible reconstructive methods to a few procedures. Employment of operations which would be suitable for an older patient may produce distortion in the younger man.

The essential concept to be borne in mind when planning the repair is the amount of tissue loss which has occurred as a result of the destructive action of the wounding missile (figs. 1, 2, 3, 4, 5). All too often ill-conceived reparative operations are begun, considering only the presenting aspects of the contracted scar. Trying to pull tissues together to repair such a defect further exaggerates the contraction which has occurred, and the condition is made worse. Only by replacement of the tissue loss can full correction be attained.

TREATMENT METHODS

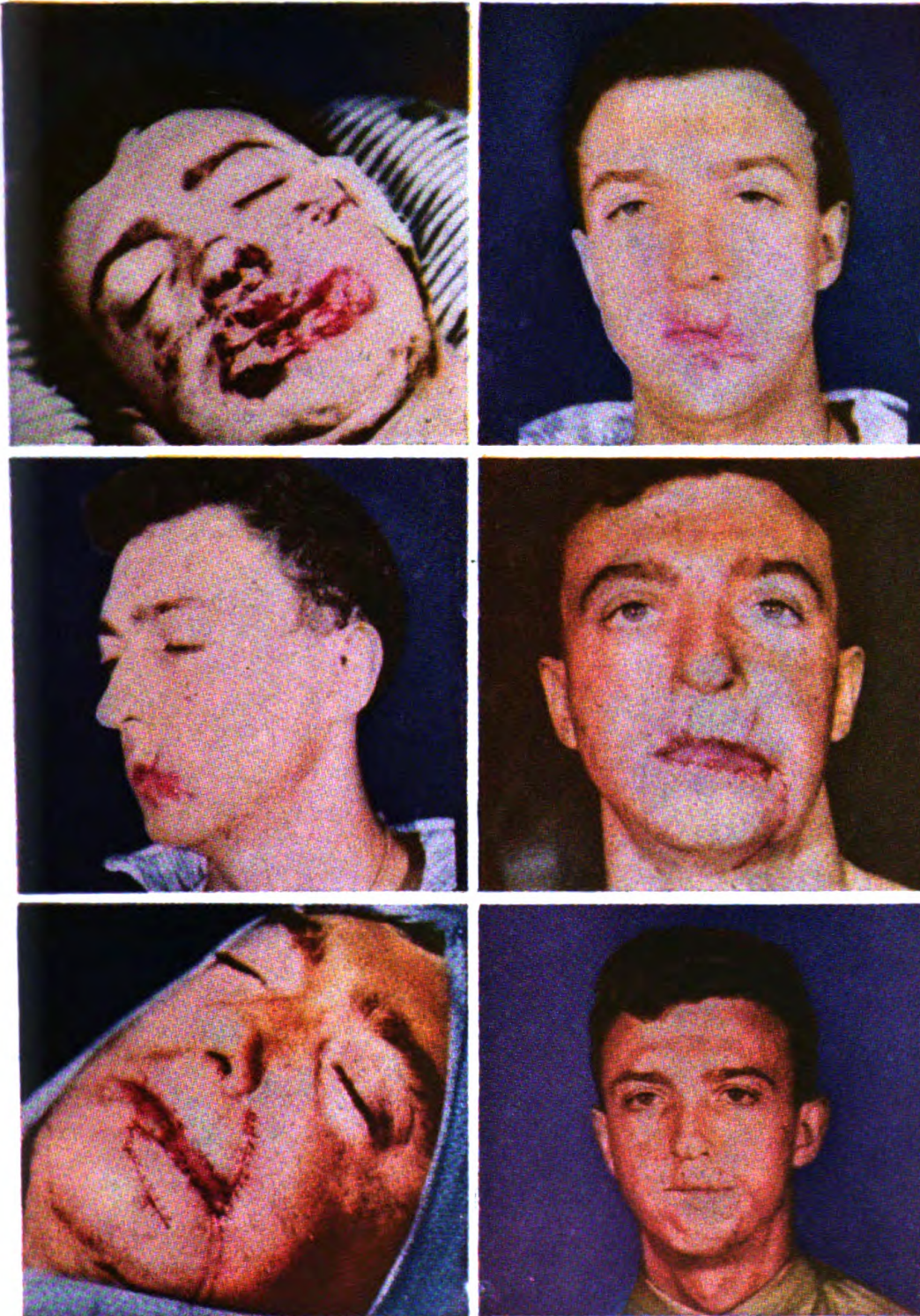
Early.—Good surgical care at the time the wounded man is first injured can do much to facilitate his later treatment. In addition to the usual methods for care of the wounded, two major points should be strictly observed in this type of case:

1. Conservative debridement: The good blood supply and high local tissue resistance of the lips and cheek render extensive debridement unnecessary, and if only loose tissue fragments and foreign bodies are removed, the wounds need not be excised in the radical fashion indicated in other parts of the body.

2. Suture of mucous membrane to skin: When the missile has produced a wound which communicates with the mouth, the mucous membrane should be sutured to the external skin after removing loose tissue fragments and foreign bodies. Much late

-
1. (Patient B). (Upper left). Appearance of shell-fragment wounds of lips. Patient photographed a few hours after wounding on Saipan.
(Upper right). Almost complete stenosis of the mouth with much scarring. Appearance when admitted to U. S. Naval Hospital, Bethesda, Maryland.
(Middle left). Lateral view at time of admission, showing contracture of scar.
(Middle right). First stage of operation illustrates use of local tissue. All scar is excised and mucous membrane advanced to form a vermilion border.
(Lower left). Second stage, transferring regional flap of skin and subcutaneous tissue from upper lip to lower.
(Lower right). Early end result (front view).

WOUNDS OF LIPS AND CHEEKS—WEBSTER



1. See legends on opposite page.

infection and necrosis of tissue will thus be prevented.

Late plastic repair.—The use of local tissue has the advantages of simplicity and good matching of color and texture. It is therefore used whenever possible in order to avoid distortion of features or facial contours. When local tissues are insufficient, or when distortion or further scarring would result from their use, tissues from some distance away must be utilized. Here again color and texture should match the appearance of the local skin as closely as possible. In this case the neck or forehead supply the next most perfectly matching skin. Neck donor sites should lie below the collar line, while the forehead should be utilized with care, if at all. To use the central portion of the forehead for repair, with its attendant scarring, seems unforgivable except in extreme cases. Adaptations of the "sickle-flap" of New¹ result in practically no visible scar (fig. 3), and provide excellent duplication of normal color and texture.

Pedicle flaps from the arms or abdomen do not match the face in any way approximating the normal skin. The cosmetic result is so inferior to other methods that it should be reserved for those seemingly hopeless cases where functional result alone is sought. Free grafts of full-thickness or split-thickness skin are almost always unsatisfactory for the repair of lips or cheeks.

TECHNIC

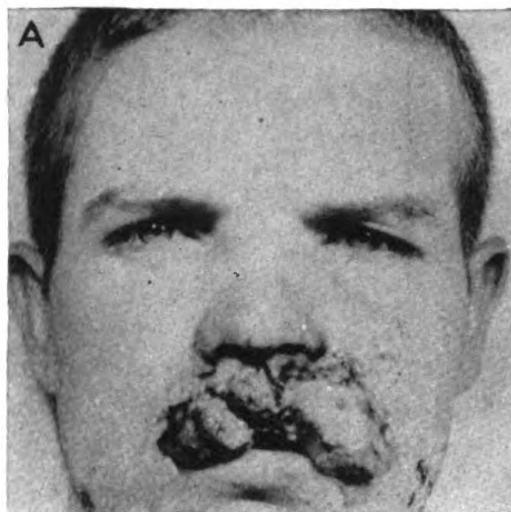
Local tissue (fig. 1).—Tissue from the region of the defect can often be rotated or advanced in such a way that no apparent loss occurs following the tissue shift. This is done by rotating triangles of skin and subcutaneous tissue from their normal bed into the defect, and then undermining and closing the secondary defect by relying on the elasticity of the surrounding skin.

All contracted and inelastic scar-tissue is excised and the original defect is thus recreated. The remaining repair may have to be done in stages to secure proper blood supply for the rotated flaps. Mucous membrane can be similarly advanced from within outward to create a new vermilion border for the lips.

Local tissue (Abbe-Estlander operation) (fig. 2).—One of the most consistently useful operations in plastic surgery is the Abbe-Estlander operation in which tissue from one lip is rotated to repair a defect in the other.

This operation with its many variations gives an excellent color match and contour when properly performed. It may often be

¹NEW, G. B.: Sickle flap for nasal reconstruction. *Surg., Gynec. & Obst.* 80: 497-499, May 1945.

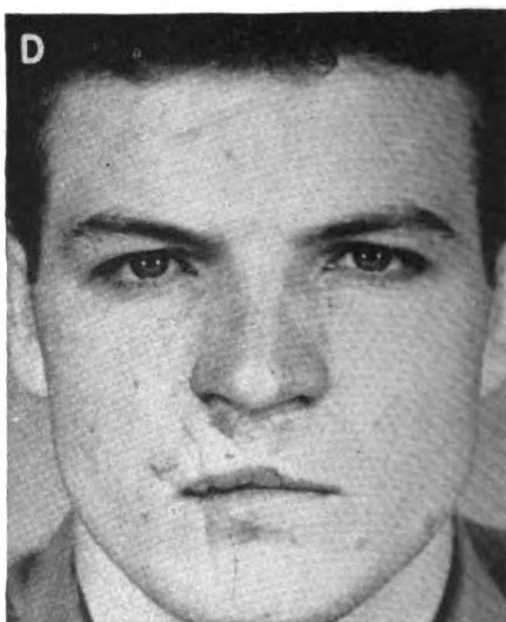


B. Appearance of healed, contracted scar on entry in this hospital.

2. (Patient S). A. Extensive destruction of upper lip following wounding on Saipan.



C. Reconstruction of upper lip by Abbe-Estlander operation, using full thickness of lower lip, and advancement of cheek flaps.



D. Early postoperative appearance. There is still slight redness of the scars.

supplemented by advancing and rotating cheek flaps.

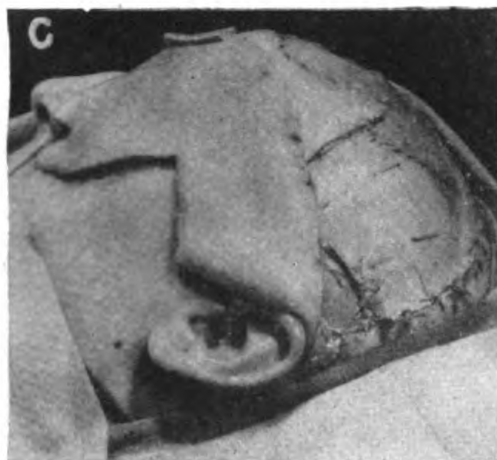
Forehead flap (fig. 3).—A properly selected forehead flap, based on the "sickle-flap" principle of New, can often give a substantial repair of defects about the nose, cheek and lips without appreciable scarring of the donor forehead. This is done by utiliz-



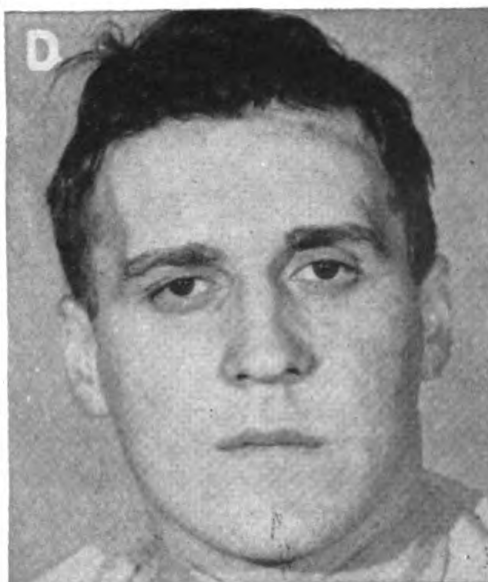
3. (Patient M). **A.** Bullet wound, missile traversing upper lip, entering on right side and having large wound of exit.



B. Appearance of contracted scar on entry in this hospital.



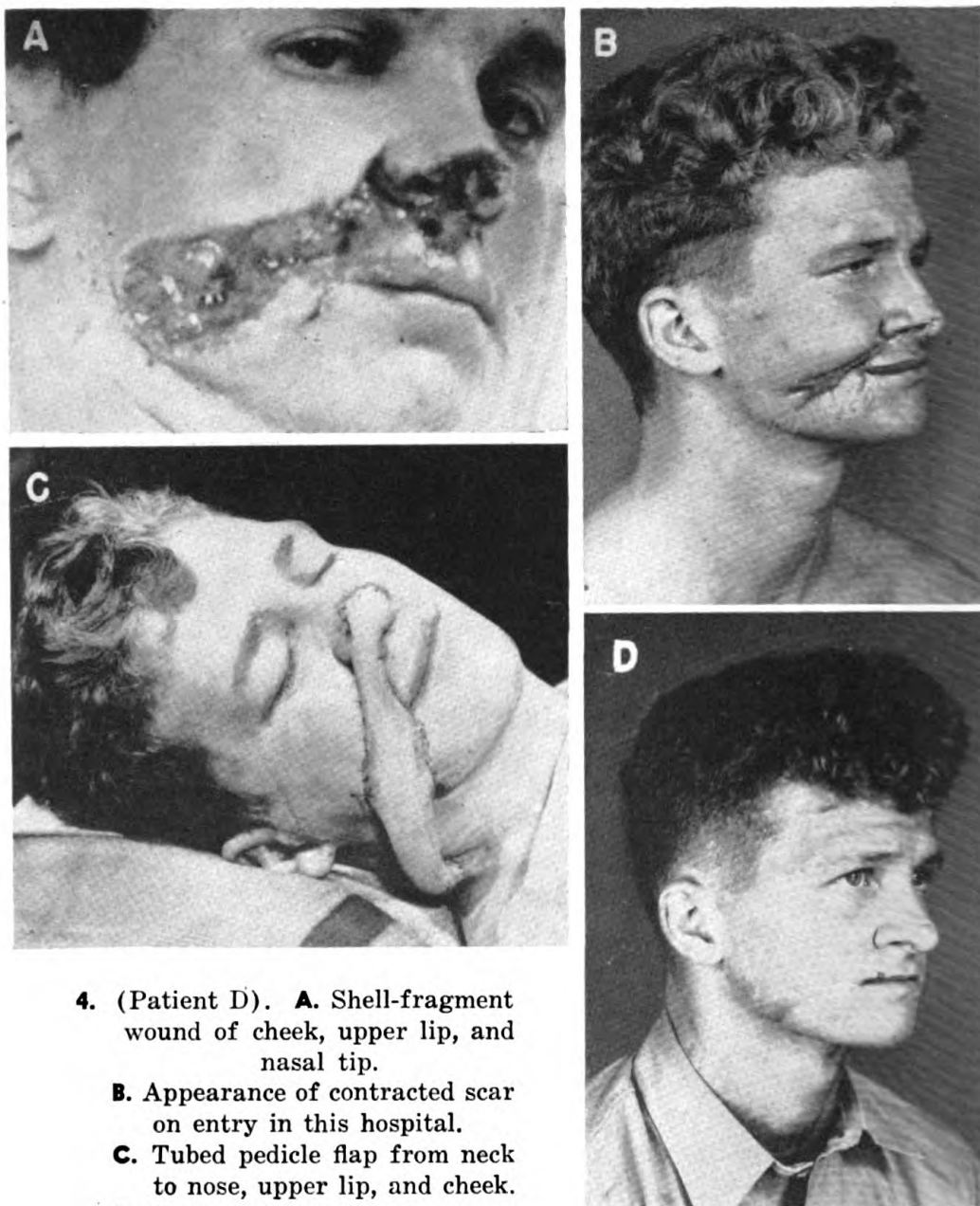
C. Forehead flap providing matching skin and subcutaneous tissue. The scalp defect is covered "temporarily" with a thick-split skin graft.



D. Early end result.

ing hair-covered scalp as the carrying pedicle. It provides source material for relief of contractures in intricate corners where local tissue cannot be advanced or rotated sufficiently without distortion.

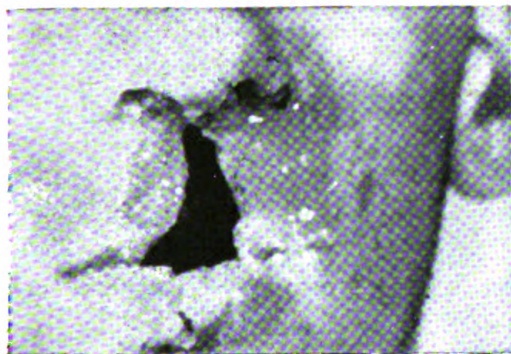
Neck tube (fig. 4).—Where the defect to be repaired is not too wide and no lining is required, a tubed pedicle flap can be formed in the direction of the normal skin-lines of the throat and then transferred to the cheeks and lips or nose as required. Such flaps



4. (Patient D). **A.** Shell-fragment wound of cheek, upper lip, and nasal tip.
B. Appearance of contracted scar on entry in this hospital.
C. Tubed pedicle flap from neck to nose, upper lip, and cheek.
D. Early end result.

match local tissues well after several months of exposure to weather and sunlight and give very satisfactory repairs.

Neck flap (fig. 5).—A rather wide pedicle flap can be removed from the neck, and the bed from which the flap was raised can be covered with a thick-split graft from elsewhere on the body. A flap of this type is useful for more massive repairs of the lips and cheeks and gives excellent color and texture. If the flap is to cover a defect which communicates with the oral cavity, a lining is necessary. In some cases a flap can be folded on itself to provide a lining. In others, when the exposed undersurface of the

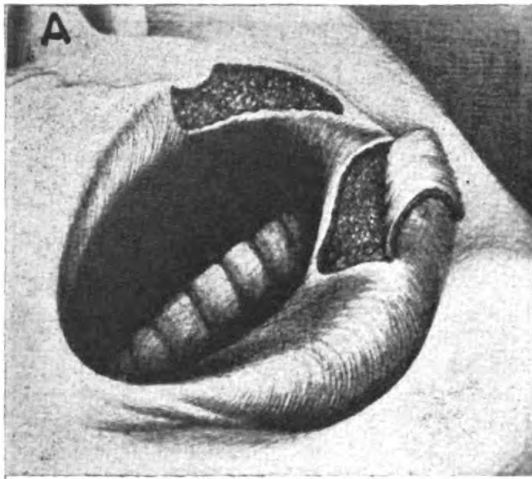


5. (Patient C). Lip destruction, with appearance on admission to Bethesda, and early postoperative appearance after use of pedicle flap from neck.

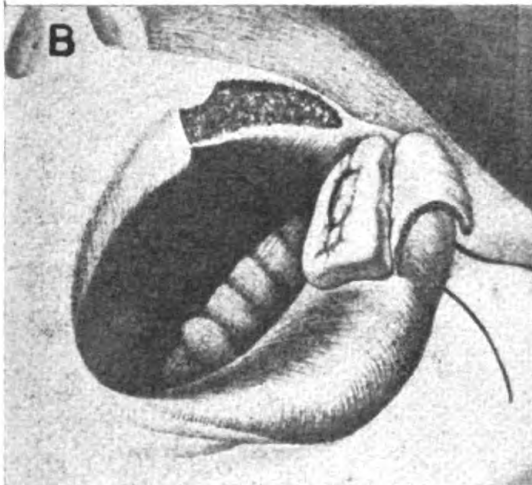


flap is not too large, a thick-split graft will serve satisfactorily.

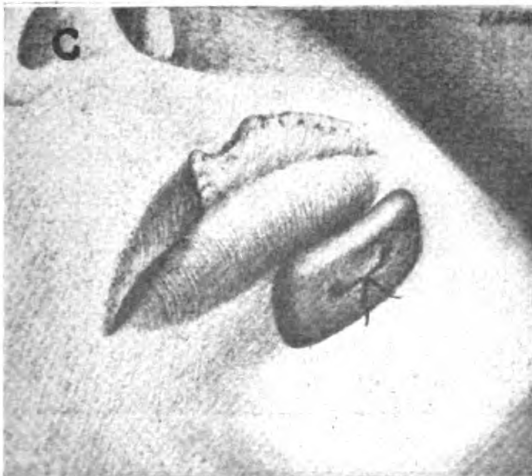
A further problem is presented when such a flap is used to make a lip. The normal vermillion border must be replaced. A number of methods have been suggested for this purpose, including cosmetics and tattooing. A much more satisfactory method (fig. 6) is provided by an adaptation of the Abbe-Estlander principle, supplying the missing mucosa from the lower lip, and skin-grafting the defect from which the mucosa originates.



6. (Patient C). **A.** Pedicle flap on upper lip is divided and flap of mucous membrane is raised from the lower lip.



- B.** Skin graft, wrapped about dental modeling compound and tied in place over the raw surface, securing it to another molded form externally.



- C.** Mucosal flap in place, showing reconstructed vermilion border on upper lip. After 10 days this flap is growing in its new location, and the lower lip can be reshaped because of the skin graft which lines its inner surface.

SUMMARY

War wounds of the lips and cheeks provide problems for the plastic surgeon wherein specially selected methods are necessary to give good results. The size of original tissue loss must be considered in estimating the repair. Early care should emphasize: (1) Conservative debridement where possible; and (2) suture of mucous membrane to skin. Late repair should be confined to replacement by local tissue or by matching tissues only.

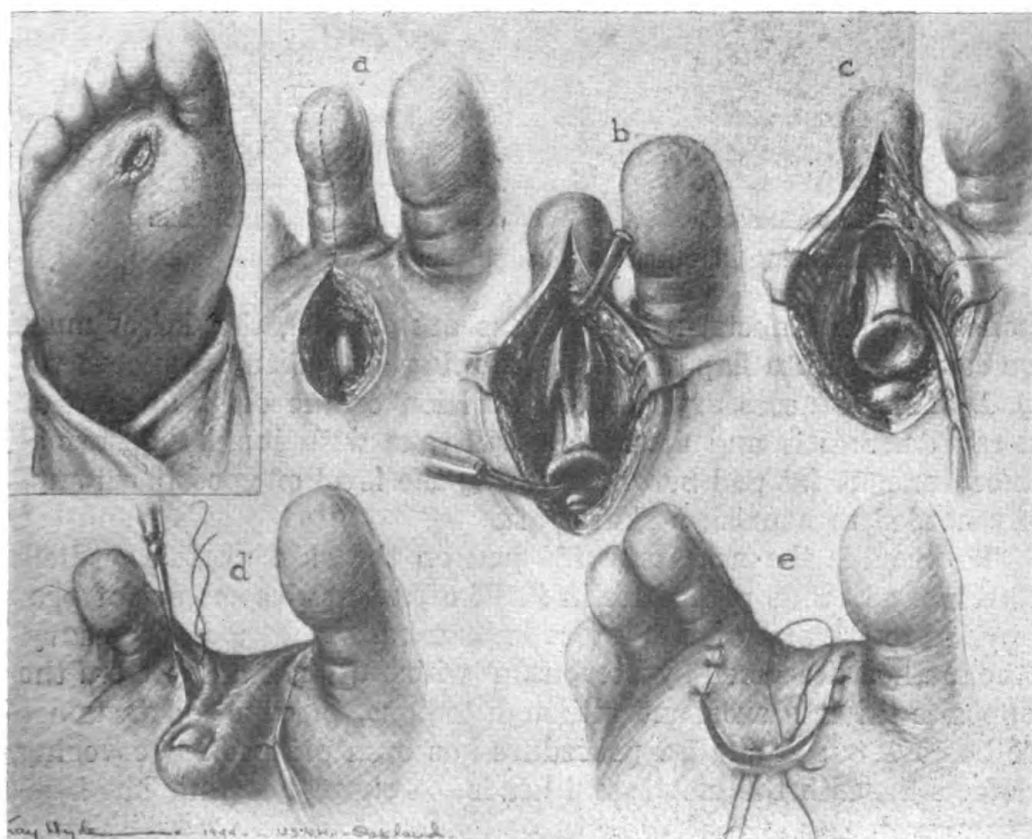
PLASTIC REPAIR OF RADIATION ULCERS OF THE SOLE

PAUL W. GREELEY

Commander (MC) U.S.N.R.

In the treatment of plantar warts conservative measures are usually successful, but the more stubborn lesions often are refractory to any therapy. Many patients with such lesions have had the unfortunate experience of receiving excessive doses of x-ray or radium treatment. X-ray dermatitis follows, and in some cases x-ray necrosis, with the formation of a typical x-ray ulcer. Treatment of the complication then entails plastic surgery.

Lesions along the instep can usually be excised back to an area of good blood supply, and the defect covered with a primary split-thickness skin graft. Unfortunately, however, the patients seen in military service are usually those who have painful x-ray ulcers on weight-bearing areas, sometimes the plantar surface of the heel, and still more frequently below the heads of the metatarsal



1. Operative procedure.

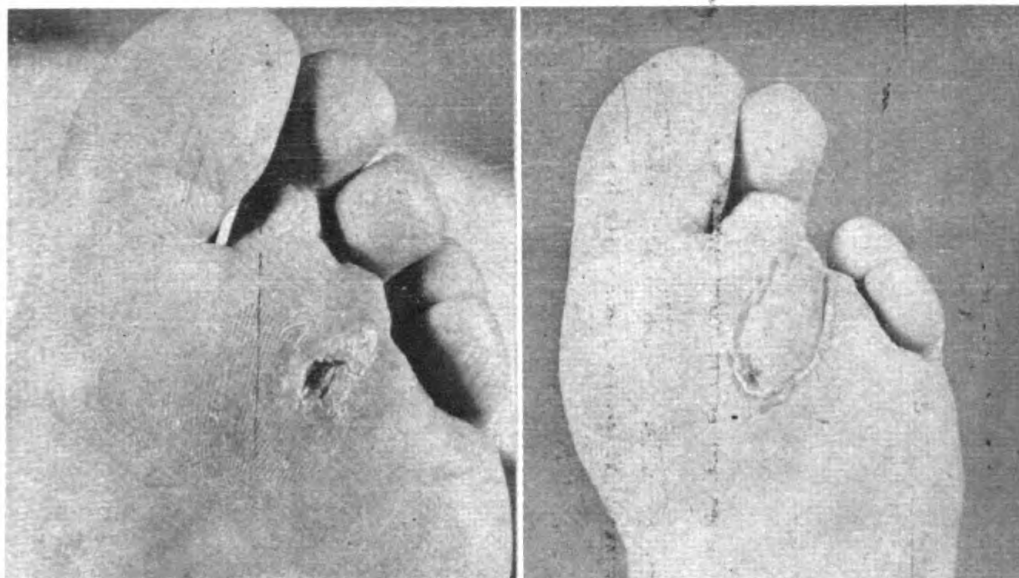


2. Showing amputation through phalanx of middle toe.

bones. When defects in these areas are excised, the defect must be covered with a flap of skin containing a good subcutaneous fat pad. This is necessary because excision of the original area of x-ray dermatitis and ulceration will take with it all the normal subcutaneous fat pad before reaching the level of good blood supply needed to nourish a skin graft.

To provide the necessary fat pad on the skin graft a pedicle flap is used. This procedure in itself oftentimes seems out of proportion to the size of the defect to be covered, but it is necessary. The method described by Stevenson¹ which utilizes a flap from the opposite thigh is excellent, although tedious, when heel defects are to be covered. A similar procedure has been utilized for covering defects beneath the metatarsal heads. A simpler technic has been

¹ STEVENSON, T. W.: Transactions, Twelfth Annual Meeting, Am. A. Plastic & Reconstructive Surgery, 1943.



3. A typical case.

used here, and will be described.

It is agreed among most orthopedic surgeons that the loss of any one small toe does not impair the balance of the foot. This statement, of course, does not apply to the great toe. It was suggested² that a disabling x-ray ulcer beneath the metatarsal of the index toe be treated by excision, "fileting" the bone from the digit, and covering the defect with the skin of the toe.

The operation consists in making an incision (fig. 1) along the plantar surface of the toe and extending it posteriorly to include and excise the x-ray ulcer. The skin flaps are reflected laterally, care being taken not to injure the digital vessels and nerves. The flexor tendons are divided and reflected anteriorly. The phalanges are then "fileted" back to the metatarsophalangeal joint, which is disarticulated. The remaining skin flap with its fat pad is turned posteriorly, and after removing the excess, including the toenail, is sutured into the defect under the metatarsal head.

² BUNNELL, S.: Personal communication.



In subsequent cases, where a shorter skin flap was needed, the bony phalanx was divided just distal to the metatarsophalangeal joint (fig. 2). Theoretically this should give a more stable foot, but practically the difference is neither objectively nor subjectively noticeable. A typical case is shown in figure 3.

SUMMARY

Plantar warts with late x-ray or radium therapy complications may present serious disabilities, especially to those in military service. A simplified method of plastic repair of those lesions developing under the metatarsal heads is presented. It should be pointed out that the procedure is limited to those lesions near the bases of the small toes; the great toe should never be sacrificed.



HEATING PARENTERAL SOLUTIONS

The subcutaneous and intramuscular injection of various medicaments, particularly liver extract, is followed by considerable pain. Even the practice of adding 1-percent procaine hydrochloride to each injection has not overcome this difficulty. A review of the procedure showed that most solutions are given almost immediately after removal from the storage icebox without effort to bring the solution to room temperature. It has been observed that placing a cold clamp on muscle tissue during surgical procedures, or a cold compress, causes a tetanic type of contraction in the muscle, whereas a warm clamp or a warmed compress has no such reaction. The pain of severe muscle contraction is well known. The injection of cold solutions into muscles at icebox temperature, therefore, results in spasmodic contraction of the muscle of a severity to cause pain.

A series of patients received liver extract, thiamine, or penicillin solutions in split doses in both deltoids, one-half of the solution warmed and the other injected at icebox temperature. The patients were not apprised beforehand of the temperature of the solutions. The subjective responses of pain or lack of pain during and after the injection coincided with the administration of either the cold or warm solution, the former invariably causing considerable pain, and the latter producing no pain or only a slight tenderness at the injection site, which persisted for 15 or 20 minutes.—DAVIS, J. H., Lieutenant (MC) U.S.N.

ORGANIZATION OF THE MEDICAL SERVICE IN THE U.S.S.R. NAVY

FEDOR ANDREYEV

Major General, Chief of the Soviet Navy Medical Service

Three main tasks have confronted the Soviet Navy Medical Service in wartime: First, prevention of epidemics; second, organization of effective treatment for the sick and wounded, and third, cooperation to ensure success of combat operations carried out by Naval vessels, aircraft, and coastal units.

History knows of many cases where the epidemic factor was important in deciding the outcome of the most brilliant military plans. It will suffice to recall the failure of Napoleon's campaign in Arabia where he lost a great many troops from an outbreak of the plague; the danger of epidemics also influenced his decision to leave Syria.

The grim war thrust upon the Soviet Union in 1941, and the re-allocation of Navy personnel evacuated from various Naval bases, put a heavy strain on the Navy medical service. However the statistics for the past 3 war years show that the incidence of sickness in general, and of contagious diseases in particular, among Navy personnel remained the same as in peacetime.

The second problem, organization of effective treatment for the sick and wounded, is essentially a humanitarian one. Its solution, in addition, means the return of trained and battle-tested sailors to the ranks of the Navy. According to the French, the fact that close to 80 percent of French battle casualties were returned to active service made it possible for France to defeat Germany in World War I.

Due significance has been given in all countries to the question of returning men from the hospitals to the ranks. This question, it is interesting to note, was not considered important by the German Army even in World War I. In a study entitled "Military Field Surgery and Surgical Service in the Army" the French physician Clavelin describes the following episode. During the occupation of Leon Notre Dame by the Germans in 1918, a German physician made the following remark to a French Army doctor: "The money which you squander on treating your wounded we spend to buy guns and ammunition."

The technical specialists that make up the personnel of the modern Navy represent a great investment on the part of a government. Much time and effort are required to train them. The medical service therefore did everything in its power to return as many of the wounded and sick to the ranks as possible.

True, it is still too early to draw final conclusions as to the efficiency of the medical service, for the available material requires careful study. It is possible, nevertheless, to point out the approximate results, since they are sure to be close to the final ones. According to data compiled by the statistics bureau of the Navy Medical Service, the number of sick and wounded returned to active service exceeded all the figures ever published in medical literature.

The third task confronting the Navy Medical Service was to cooperate in all possible ways to ensure the success of combat operations carried out by vessels, aircraft, and coastal units. Among the problems involved here were adequate medical examinations in selecting contingents for ships, submarines, and aircraft; and the importance of correct diet, uniforms, daily regimen and recreational activities, in increasing the stamina of flyers and submarine crews. The medical service also took an active part in working out technical data concerning the purification of air in submarines, the design of surface ships and submarines, and the construction of Naval bases, barracks and coastal fortifications. Problems of night vision and of regulating daylight lighting for flyers, anti-aircraft gunners and observers have also been studied by Navy physicians.

THE OPERATIVE TACTICAL SITUATION IN THE SOVIET NAVAL WAR THEATERS

The Soviet Union is a sea power. Almost 35,000 kilometers of its borders are washed by the waters of various seas and oceans. We have always had a goodly number of plucky and daring sailors whose native element was the sea.

When the war broke out, the Northern, Baltic, and Black Sea fleets were at once drawn upon for combat. In addition to these fleets, a number of flotillas on the lakes and rivers of the Soviet Union saw action in Naval combat.

During the whole course of the war the strategic flanks of the Red Army had reliable cover in Naval forces, and there was not a single instance of our Army being attacked from the sea. Furthermore the Navy coordinated with land forces by supporting the Army's flanks with ships' artillery. Such was the case more than once in Leningrad, Stalingrad, Odessa, and Sevastopol as

well as on the Kerch Peninsula and in many other sectors. Moreover the firm and determined defense of Naval bases forced the enemy to hurl superior numbers against our defenses and thus to lose time and men.

The enemy had to reckon with the strength of the Russian Navy to such an extent that even when the whole of the Crimea was in



Major General Fedor Andreyev, Chief of the Medical Services of the Navy, U.S.S.R. (the position corresponding to the Surgeon General, U. S. Navy).

their hands they dared not risk crossing the Kerch Strait, but penetrated into the Caucasus by skirting the Sea of Azov overland from the north through Rostov-on-Don.

On the other hand, raiding operations of the Soviet Navy and numerous landing operations in enemy-occupied territory compelled the Germans to be constantly on the alert for possible attacks from the sea and to maintain considerable forces in the

rear for this purpose which might otherwise have been utilized on the front.

Landing operations were carried out for purposes of sabotaging enemy measures, as well as for tactical and operative purposes. Such operations were carried out in the North in Motovski Gulf, in the Baltic Sea near Leningrad, in the Black Sea near Taganrog, Mariupol, Nikolayev, Ochakov, and elsewhere. Among the major landing operations in which combined Army and Navy forces saw action were those at Kerch, Feodosia and Novorossiisk. The Soviet Navy acquitted itself with honor in the task of maintaining its own Naval communications and in destroying those of the enemy.

The isolation of the Northern Fleet, the blockade of Leningrad, and the defense of Odessa and Sevastopol presented great difficulties in the delivery of medical supplies and the evacuation of wounded. The situation was such that it required a medical service capable of dealing with all problems that might arise. These problems included the treatment of the sick and the wounded, and also the elimination of various threats of epidemics.

In order to have some idea of the scope of work, it is necessary to point out that the Navy medical service was responsible for the transport and care en route of all wounded and sick, both Navy personnel and those who came from land units and were evacuated over water routes. It must be borne in mind that the number of persons requiring evacuation by sea ran well into the hundreds of thousands.

Difficulties of a technical nature in supplying besieged Naval bases with provisions as well as the specific foods required in the Trans-Arctic regions made it necessary to keep a strict watch over the physical condition of the Navy forces. A system of sanitation measures, special rest homes and sanatoriums, and periodic medical examinations and measures were very effective in maintaining the combative powers of Soviet Navy personnel at the same high level during the whole course of the war.

ORGANIZATION AND STRUCTURE OF THE U.S.S.R. NAVY MEDICAL SERVICE

The Navy Medical Service is charged with the supervision of all medical measures in the Soviet Navy. The Medical service consists of an operative unit which in turn consists of departments in charge of the formation of medical and sanitary institutions, staffing them with medical personnel, carrying out anti-epidemic measures, organizing medical treatment in hospitals and combat units, medical training of Navy personnel and medical units, and

acquisition and distribution of special medical supplies.

In addition to these departments, the Navy Medical Service includes outstanding medical men who are directly subordinate to the Chief of the Navy Medical Service and who hold positions as chief medical specialists of the Navy. Among these specialists are the Chief Surgeon of the Navy, the Chief Therapists of the Navy, and the Chief Epidemiologist of the Navy.

For supervising and controlling the work of other medical specialists the Chief of the Medical Service also has special consultants in otolaryngorhinology, ophthalmology, psychiatry, neurology, roentgenology, and all specialties. Consultants do not hold permanent posts in the Medical Service but are called in for special cases from time to time. In addition the chief of the Medical Service may call upon the services of the Navy Medical Research Institute and the Navy Medical Academy to do any work necessary for solving various problems involving the welfare of the Navy.

The Medical Research Institute engages in the study of problems concerning living and working habits of the personnel of surface and submarine craft, naval aircraft, and coastal units. This Institute has a staff of well-known scientists, among whom are many professors.

The Navy Medical Academy takes an active part in working out scientific problems concerning the Navy, but it is primarily an academic center with its own departments and affiliated Navy Medical School, with advanced courses for Navy medical officers. Only those who are graduated from senior secondary schools with excellent records are eligible for enrollment in the Soviet Navy Medical School. Students of this school are graduated as Navy physicians with the rank of lieutenant in the Medical Service. During their studies at the school, students are maintained completely at government expense. They cover the entire course of medical training as well as specifically Naval subjects.

Navy physicians with some practical experience in their specialty, gained during service on board ship or in Navy units or hospitals, are eligible to attend the advanced courses maintained at the Navy Medical Academy. There are special courses in the various medical specialties. The academy has its own various departments for training highly qualified specialists to take charge of work in large Navy hospitals, laboratories, and other institutions. Candidates for study in these departments are selected from among the best and most experienced physicians in the service. The Navy Medical Academy is a large institution with its own large hospital and trained staff of teaching specialists.

Another branch under the Chief of the Medical Service is the Scientific Medical Council which consists of outstanding specialists from the Navy Medical Academy, the Medical Research Institute, and the personnel of the Medical Service, as well as from the Army and civilian scientific institutions.

Plenary meetings of this council are held periodically to discuss questions of sanitary tactics and hygiene in the Navy, applied physiology and various topics of clinical medicine. Despite wartime difficulties, the council held its regular annual plenary meetings, at which the experience gained in various spheres of medical knowledge was discussed and summarized.

The activities of the council are managed by a permanent scientific secretary who is in charge of all technical matters and publications. The Council regularly publishes the "Proceedings of the Scientific Medical Council."

The Medical Service also studies and summarizes wartime experience. A record is kept of all documents sent in from the various fleets which may be of historic significance and require detailed study. The Medical Service likewise has a staff of translators who look over all the foreign literature received, and translate or review any articles of special interest.

Mention also must be made of certain important organizations set up in the last 2 years under the auspices of the Navy Medical Academy. One of these is the Archive of Case Histories. Material for this is sent in from all Navy medical institutions to be worked over according to special indications and the type of disease involved. These case histories are sent to the Archive every 6 months so that hospital workers have every opportunity to study and systematize all the data contained in these documents. The centralized study of these documents enables research workers to make detailed analyses of various questions and to base their conclusions on large-scale reliable data.

Another newly-established unit subordinate to the Navy Medical Academy is the Museum of the Navy Medical Service. The Museum staff was charged with collecting all wartime material such as photo-documents, equipment and supplies, classifying and cataloguing documents on separate episodes of the war, and collecting medical trophies.

The final item to be mentioned here is the publication of the bulletin, *NAVAL SURGEON*, which appears quarterly in issues of 80 pages each. The size of this bulletin does not permit the publication of much of the interesting material submitted to the editors.

Supervision of all medical and sanitary services is effected through the medical departments of fleets and flotillas functioning

in every autonomous theater of war. These departments are similar in structure to the medical service and have corresponding subordinate departments and sections. In addition the medical department of each fleet has highly qualified, so-called flagship specialists in surgery, therapeutics and epidemiology. These specialists are usually professors with many years of experience in their particular field. Department chiefs also invite experienced hospital specialists to work as consultants.

Mention must also be made of the courses for Navy medical officers functioning at the main hospital of each fleet. Navy physicians are sent to these courses for short terms of special study in some clinical subject and in epidemiology.

ORGANIZATION OF MEDICAL SERVICE ON VARIOUS TYPES OF SHIPS

There are no essential differences between the Soviet Navy and the American Navy in regard to the cardinal principles governing their medical services.

The first point to note is that in the Soviet Navy, as in the American Navy, stress is laid on training all ship crews in methods of rendering first aid, both to themselves and to others. Every sailor has to know how to use an individual sterile bandage package correctly and how to apply a tourniquet and the simplest immobilizing splint. He must also know how to give a subcutaneous injection of morphine, using a specially prepared tube, and how to carry stretchers. This is all very important on vessels of large tonnage, on which the battle stations are isolated during an alert, and still more important on ships of small tonnage which carry no medical personnel at all. All the property necessary for rendering medical aid is kept in special metallic containers or canvas bags at every battle station. These primary stations on ships of large tonnage are called "first-aid points." Besides these the battleships and cruisers also have three or four "medical-aid points" staffed by a doctor and a *feldscher*.

The last-mentioned term is applied to a medical worker who has not had the benefit of a higher medical education, but does have command of the whole technic of special work (with the exception of surgical operations). The *feldscher's* duties include the diagnosis of the most prevalent diseases, bandaging, giving subcutaneous injections, working in the pharmacy, drawing up medical reports, and organizing operating rooms. The smaller classes of vessels carry *feldschers*, but squadrons of such ships also carry a flagship medical officer in common.

Certain classes of small-tonnage ships carry no medical personnel at all. Since they invariably gravitate about a floating or

coastal base, their crews obtain the necessary medical aid at the medical-aid-point bases.

This type of organization is quite satisfactory in regard to sanitary and epidemiologic service and the treatment of diseases, but the organization of aid for the wounded requires special consideration.

Today we all know that the outcome of a wound depends primarily on the quality and comprehensiveness of the first aid rendered. Almost all surgical measures yield satisfactory results only if they are taken in good time. The active debridement of wounds of the soft tissue, for instance, must be effected within the first 12 to 24 hours. The inhibitory action of the sulfonamide drugs on the development of wound infections has been sufficiently demonstrated, but it cannot compare with the results obtained by the timely use of the scalpel. The above applies primarily to wounds that have a long wound canal into which it is impossible to introduce a sulfonamide. It also applies to cavity wounds, especially wounds of the abdominal, cranial, joint, and thoracic cavities. Despite all the arguments of those who are enraptured with the successes of chemotherapy of wounds, timely surgical intervention must be recognized as necessary. For this reason the slogan that "every wounded man must not only have timely first aid and the medical aid of a qualified physician, but also timely, qualified surgical aid" has been adopted as a rule in the organization of medical service for the wounded on the ships of the Soviet Navy.

In studying the combat experience of ships of large tonnage, it was found that wounded men were rarely transferred from aboard ship to the shore in the course of the first 24 hours. Very often they had to remain on board for several days.

Thus, for instance, after its battle with the British cruisers *Ajax*, *Achilles*, and *Exeter* on the La Plata River, the German wounded remained on board the *Graf Spee* for 4 days. British ships fought with the German battleship *Bismarck* on 27 May, 1941, but did not return to their base at Gibraltar until 30 May. Thus the wounded on board these ships likewise remained there 3 days. The circumstances cited are testimony to the fact that ships of large tonnage (battleships and cruisers) should provide every opportunity for adequate surgical treatment of the wounded, and also the requisite conditions for their everyday care.

With this purpose, even before the war, qualified surgeons were appointed to head the medical services on large ships. In May 1941 the first plenum of the Medical Council drew up a detailed list of instructions on the procedure and nature of the surgical measures that were to be applied on ships of all types. These in-

structions were entitled "Extent of Medical Aid on Naval Ships."

In accordance with these instructions the following aid is given to the wounded at medical-aid points on board large ships during a battle (if they can be brought to the point while the battle is still in progress) :

1. Subcutaneous injection of morphine.
2. Fixation of the tongue when the jaw is fractured.
3. Insertion of a tracheotomy tube when necessary.
4. Temporary closure of an open pneumothorax (occlusion dressing, provisional suture of the wound).
5. Counteracting shock (wine, narcotics, cardiac stimulants, warmth, rest).
6. Temporary arrest of hemorrhage (pressure dressing, tourniquet, tamponage).
7. Readjusting dressings applied at the first-aid point.
8. Immobilization of fracture by standard splints.
9. Suprapubic puncture of the bladder or its catheterization.

After a battle the casualties are sorted in the sickbay, after which the following procedures are carried out in the order of their urgency:

1. Tracheotomy.
2. Surgical intervention in cases of open and valvular pneumothorax.
3. Transfusions of blood, plasma and blood substitutes when urgently indicated.
4. Radical arrest of bleeding from wounds and removal of tourniquets.
5. Injection of antitetanus and antigangrene serums.
6. Registration of the wounded.

These measures are taken at all medical-aid points staffed by a medical officer, regardless of his particular specialty.

If after these measures the casualties cannot be delivered to special medical institutions soon enough, the following surgical operations are performed on board ship:

1. Laparotomy.
2. High section of the bladder.
3. Radical treatment of all wounds.
4. Amputation of devitalized limbs.
5. Trephination of the skull (if the conditions for subsequent evacuation permit).

Normally ships that carry only one medical officer are not equipped for the performance of special operations. Every medical officer, however, is obliged to have the training requisite to enable him to carry out the first two lists of measures, for the medical equipment on board ship is fully sufficient for them.

After a battle, every physician serving on board a ship reports to his commander the presence of wounded on board ship who require qualified surgical aid. These wounded are to be transferred

as soon as possible to coastal medical institutions, to a hospital ship, or to a ship that carries a surgeon.

A surgeon is sometimes appointed to a squadron of ships when it departs on a special mission entailing prolonged absence from shores, in which case he is furnished with all the necessary medical equipment.

The use of the "mosquito fleet," i.e., motor torpedo boats, armored motor boats, etc., became widespread during this war. These small-tonnage ships carried no medical personnel at all. Yet every sailor serving on these ships received all-round medical aid at the shore base if wounded.

If the bases of these ships happened to be located near a Naval hospital, only the medical-aid point of the squadron gave the treatment listed in the first two categories and then sent the wounded on to the hospital.

Sometimes, however, the base of a squadron of this type was remote from any large populated point or Naval port. It frequently took from 2 to 12 hours and more to evacuate wounded to a hospital. In such cases either a medical officer who possessed surgical qualifications, or a special mobile surgical group, depending on the contingent of wounded to be served, was appointed to the coastal or floating base of these small vessels.

MEDICAL SERVICE WITH LANDING FORCES

Even before the war, on the basis of theoretic research, the basic instructions for the medical service of landing forces were drawn up. The experience gained in wartime in our own Naval theaters, and also the available material on the landing operations carried out by the American and British fleets at Dieppe, in North Africa, Sicily and on the northern coast of France, have not introduced any appreciable changes in these principles.

The first principle may be briefly stated, that in view of the variety of operative tactical situations involved in various landing operations, the large diversity in the scope of the maneuvers and the differences in climatic, epidemiologic and other conditions, no standard rules applicable to all possible cases can be given. The conclusion that naturally follows is that for each individual landing operation the command must explicitly state the specific tasks which face the medical service of that operation well beforehand. Only thus can the medical service take effective part in determining upon the most rational equipment of the personnel, in arranging a correct diet, in preparing the landing craft for the crossing, and in training and steeling the troops and the medical personnel itself in good time.

Putting the problem before the Navy medical officers in good time was also a decisive factor in calculating the supplies required by medical units and institutions, in determining the size of the medical staff, the overland and sea evacuation transport means, and also in drawing up general and particular medical evacuation plans.

The second, no less important, principle to be observed in organizing the medical servicing of landing operations is, as previously stated, that every wounded man must have timely first aid and qualified surgical assistance. This principle makes the time factor of primary importance and obliges us to organize evacuation in such a manner as to ensure that the aid which each wounded man needs never reaches him too late. This has proved most difficult to effect during the first stages of the landing operation, and especially during the first thrust of the troops and the battles for the beachhead.

The following constants have been adopted by the Soviet Navy as an approximate scheme for building up a medical evacuation plan for Naval landing forces.

1. First-aid points with stretchers are set up near the gangway of each large transport. The personnel of these points should be chosen from among the embarking troops, and consist of medical orderlies and a sergeant in the medical service.

2. If trauma cases arise while automobiles, guns, or tanks are being loaded, or due to enemy guns, the orderlies of the first-aid point deliver the injured to the medical-aid point, which is best established on the territory of the port.

3. After receiving initial medical aid, the injured are evacuated by ambulance car to a hospital or to some other medical institution.

4. If there is no hospital in the vicinity of the embarkation point, the medical-aid point should be staffed with a qualified surgeon and be provided with the necessary surgical supplies.

For landing operations that involve sea crossings, during which enemy attacks by surface ships, submarines and aircraft are possible, as also coastal artillery attacks, it is considered necessary to have a medical organization on board each transport analogous to that on board battleships. In so far as possible, the medical personnel of the landing troops themselves are used for this purpose.

Thus first-aid points are established wherever large contingents of landing troops are concentrated, as also one or more medical-aid points, depending on the tonnage of the vessel.

When the troops disembark on an enemy-occupied shore, each infantry unit to hit the beach is followed by its medical unit.

"Navy sanitary evacuation posts" or "Navy medical detachments" are set up on shore for the organized evacuation of wounded from the shore to evacuation transports (i. e., transport vessels or battleships specially adapted for evacuation). They are staffed with medical workers who make all the preparations for the evacuation and embarkation of the wounded on sloops, evacuation motor boats, or other small craft, which deliver them to the evacuation transports.

In organizing medical service along the different stages of evacuation, it must be borne in mind that it takes from 6 to 12 hours to remove a wounded man from the battlefield. If the wounded cannot be given medical aid on the beachhead, or if their delivery to the nearest base that has a hospital involves a delay of more than 12 hours, qualified aid may in many cases come too late. For this reason it is very important to organize the activity of surgeons right on the landing craft. It is not absolutely necessary to use special hospital ships or evacuation transports for this purpose. Experience shows that when the medical personnel have the necessary training and experience, the ordinary types of ships used for transporting troops can be satisfactorily adapted within 2 or 3 hours to meet all the needs of the wounded.

Under the conditions occurring in the Soviet Union, special mobile surgical groups have played an important role in the war. They have been equipped with portable apparatus and have been able to work under any conditions, and especially on passenger or freight-passenger ships.

CERTAIN FEATURES OF THE EVACUATION OF CASUALTIES BY SEA

One of the most important factors in the evacuation of casualties by sea is the selection of the desirable tonnage and the appraisal of the principal tactical-technical properties of vessels designated for evacuation of wounded.

For evacuating wounded over long distances, large-tonnage ships are the most expedient, since they can accommodate a large number of wounded at one time and therefore justify the escort necessarily used to protect them. When, however, the wounded have to be evacuated across narrow bodies of water that are well within the observation and the firing range of enemy artillery, the formation of large convoys, even if well protected by an escort of battleships, is hardly rational. Such armadas attract the enemy's attention, with the result that they are attacked by artillery and aircraft.

The Navy Medical service was faced with extremely difficult problems during the defense of Odessa, Sevastopol, and Novoro-

ssiisk. In these cases the sea route was the only one open to evacuation, and ships were constantly under attack by enemy aircraft. They had to run the gauntlet of enemy coastal artillery and to brave mine fields.

Under these conditions at first we made use of strong escort for our evacuation transports, and we also made a practice of evacuating the wounded on battleships and even on submarines. Our experience, however, led us to conclude that under such circumstances it is best to resort to artifice and dissimulation. Minor vessels of 100, 200, or 300 tons which easily cover small distances and are fast (20-25 knots) and highly maneuverable, proved the most suitable for this purpose. Taking advantage of the cover offered by darkness and smoke screens, maintaining communications with the shore, protected by armed motor boats, and maneuvering in case of active coastal artillery and air bombardments, these vessels usually made their trips safely. Thus the minor craft managed to get through where larger vessels would inevitably have been sunk. Moreover it is quite natural that a small ship is not an object worthy of the attention of large aircraft squadrons or artillery groupings. They possess another advantage in that by accommodating only from 50 to 150 wounded évacués, the small ships do not place large contingents under risk at one time. And yet if they make repeated trips and if a sufficient number of them are used, large numbers of men in need of evacuation can be transported successfully.

Our war experience has also led us to observe that the contingents of wounded evacuated by sea are not alike, but rather that their character largely depends on the operative-tactical situation in the given war theater. When the territory of a Naval base is within range of enemy artillery fire, and when enemy aircraft is intensely active, the conditions under which the medical personnel work, and the calculations upon which evacuation plans are based acquire many specific features. In bases of this kind the casualties are in danger of being wounded anew. The need for sheltering them necessitates the organization of underground hospitals. Besides this it is not desirable to have too many contingents of wounded in these bases.

Casualties should therefore be left in the base hospitals only if their treatment does not require more than from 2 to 4 weeks or if their condition is such as to leave no room for hope. All the other casualties and ailing are subject to evacuation. Such Naval bases were designated first-zone bases.

Practice has shown that wounded taken on board evacuation transport ships from such bases are always in a more serious condition, require much more care en route, and more frequently

require surgical intervention than do the wounded in the interior regions. Because of this, skilled surgeons furnished with the necessary surgical equipment were appointed to such ships.

Classified as second-zone bases were those which were never within range of enemy artillery and which did not suffer excessively from attacks by enemy aircraft. If such bases were located along the evacuation routes, the casualties were sorted there, and only those whose treatment would require more than 2 or 3 months were selected for further evacuation. The others were left at these bases.

Naval bases which as a rule were not subjected to enemy aircraft attacks were classified as third-zone bases. All the wounded and ailing who required more than 3 months of treatment were sent to hospitals in the third zone.

Finally it should be emphasized that although close contact has been maintained constantly between the medical services of the People's Commissariat of Health, the Army, and the Navy, a "closed medical-evacuation system" operated in the Navy throughout the war. In other words, almost all the wounded and ailing Navy men were treated in Navy hospitals.

The "closed system" has made it possible to organize the treatment and life of the casualties in accordance with the customs and specific needs of sailors, to effect the more rapid return of the casualties to their ships, to influence the decisions of the military-medical commissions by pointing out the specific features of Naval service, and to collect and study material relating to Navy contingents in greater detail.

The above system also has enabled us to make better use of sanatoriums and rest homes for convalescent wounded.

CONCLUSIONS

The author of the present article does not doubt that the operations on the Pacific and Atlantic Oceans, like the landing operations in Africa, Italy and France, have enriched the medical service of the American Navy with extremely valuable observations and experience. The medical service of the Soviet Navy, however, had to work under very specific conditions.

In offering the present article to the attention of American Naval surgeons, the author regrets that space does not permit presentation, even in brief, of all the material accumulated in the 3 years and more that we were at war with Germany and her allies. It is to be hoped that the ties established between the medical services of the American and Soviet Navies will continue to develop in the postwar period to the benefit of both countries.

PAIN FOLLOWING INJURIES OF PERIPHERAL NERVES

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Before discussing intractable pain following injuries of the peripheral nerves, it must be acknowledged how much of this perplexing subject remains unknown. The recent hostilities provided a great opportunity for neurosurgeons in the Army and Navy to gain a better insight into its mechanism and to develop more effective methods of treatment. With the great number of patients having amputations and injuries of peripheral nerves who are today reaching our hospitals from overseas, these sources of persistent pain are certain to be a major problem for years to come.

The common injuries which may lead to persistent pain are amputations and partial or complete wounds of the peripheral nerve trunks. Concomitant injury of a large artery may also occur, but as this complication is rare, it would not appear to play any important role in this syndrome. Faulty regeneration of severed nerves, sepsis, and resultant formation of scar tissue appear to constitute the underlying factors which give rise to painful stimuli. Trotter (1), in his classic essay on "The Insulation of the Nervous System," pointed out that regenerating axones "resemble pain fibres in a lack of complete insulation. It is probable, therefore, that imperfect insulation tends to render all fibres less sensitive than normal, but more apt . . . to respond in an exaggerated, explosive way."

A further factor in the production of pain is anoxia, either from local scarring or from widespread vasoconstriction. In recent experiments Lorente de Nó (2) has shown that a nerve made anoxic fires off repetitive stimuli, which suggests that impaired circulation may be a fundamental source of painful stimulation. Another possible explanation is the accumulation of painful metabolites in the neuroma, and the failure of the impaired circulation to wash them away. Neuromas combine the two essentials of naked nerve endings in a mass of poorly vascularized scar tissue. Amputations and wounds of nerves near the periphery of a limb are most likely to set up persistent painful states because of the greater number of nerve endings and the increased role of vasospasm in these areas. The incidence of painful complications is

particularly high in the emotionally unstable person with superimposed vasospasm.

In addition to the possible role of vasospasm and local ischemia in the production of these painful states, Doupe, Cullen, and Chance (3) have suggested another factor associated with overactivity of the sympathetic nervous system. They ascribe the peculiar qualities of causalgic pain to direct cross-stimulation of sensory fibers by efferent sympathetic impulses at the point where the nerve trunk is injured, rather than to the indirect action of the vasoconstrictive response which they also produce. This theory deserves consideration, as in certain stages of the evolution of many of these painful syndromes there is actual vasodilatation.¹ Doupe and his coworkers have cited most convincing evidence for this activation of sensory fibers by sympathetic impulses. Their theory furnishes an explanation not only for the increase in pain, which so characteristically takes place in a cold environment, but also during emotional excitement, cutaneous stimulation, and, in some extreme instances, during micturition and defecation.

As further corroboration of this theory of sympathetic activation of sensory fibers, it has been shown by Katz and Schmitt (4) that under certain circumstances efferent nerve impulses can alter the excitability of adjacent sensory axones. Recently Granit, Leksell, and Skoglund (5) gave direct experimental proof of such cross-stimulation between motor and sensory fibers at a point of nerve injury by recording with the cathode-ray oscillograph the afferent discharge from the sensory root which takes place when the motor root is stimulated. They conclude that the small, poorly myelinated pain axones of the C-group should be especially susceptible to "fibre interaction," and that this is a simple explanation for some of the symptoms of causalgia. The theory of Doupe and his coworkers assumes that the activating efferent discharge comes from the sympathetic vasomotor, pilomotor, and sudomotor discharge, which is always increased by cold or emotional excitement.

TYPES OF PAIN

End-bulb neuromas, which can often be palpated in an amputation stump, can be exquisitely tender, and in addition cause cutaneous hyperesthesia. Although these two sources of complaint may be relieved by resection of the end-bulb, and effective measures to prevent its reformation, a deep aching sensation with

¹ Although the predominant action of the peripheral sympathetic neurones on blood flow is vasoconstrictive, there are also sympathetic vasodilator fibers, so that the actual effect of sympathectomy is to stabilize circulation in the extremities at a level between extreme dilatation and constriction of the vascular bed.

central radiation may persist, to a very annoying degree.

The classic causalgia syndrome, described by Mitchell, Morehouse, and Keen (6), is most often seen after partial injuries of the ulnar, median, or sciatic nerves with severe scar tissue reaction. Here the entire lower arm or leg may become hyperesthetic, with trophic changes and disturbances in circulation and sweating. The painful area is not restricted to the sensory defect. The hyperesthesia may become so intense that the patient cannot bear contact with clothing or even drafts of air, and the extremity is kept constantly protected or wet in cool water.

As wound healing improved with better surgery after the war between the States, the incidence of major causalgia was considerably reduced in World War I, and with effective chemotherapy has almost disappeared in the present conflict. An interesting group of seven cases of severe causalgia has been reported by Doupe et al. (3) from a large hospital for nerve injuries in England.

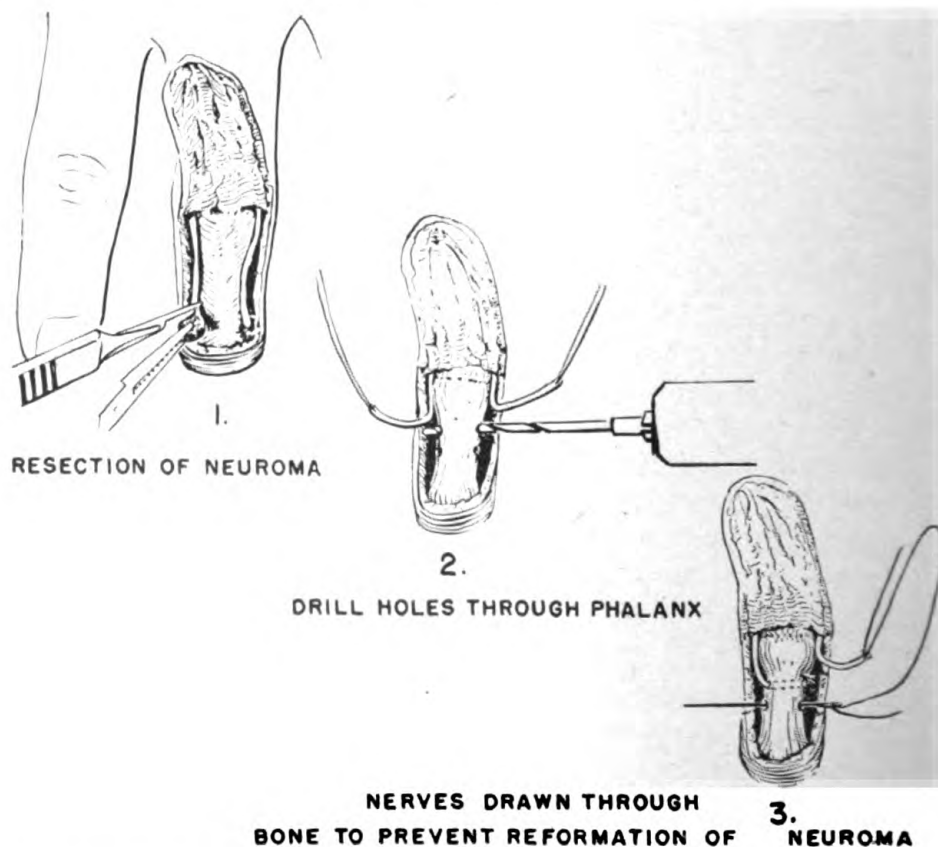
Phantom limb is a common phenomenon after any amputation. The primary source of this peculiar sensation is irritation within a neuroma of centrally conducting axones which formerly supplied the missing part. Fortunately the sensation of a phantom is not generally associated with pain, and it usually disappears with the use of an artificial arm or leg. But occasionally it fails to disappear, or may return months or years afterward in an intensely painful form. The cause of this return is usually additional trauma which may be either organic or psychic. Recurrence of pain years afterward (18 years in one of my cases) may be due to a fall with severe bruising of a leg stump and the resultant increase in scar tissue, or it may be accounted for by reduced circulation secondary to arteriosclerotic changes with advancing years.

At times the evolution of a painful phantom has all the appearance of being a psychic manifestation. This is illustrated by an unusual case seen by Mayfield (7). The patient, a tank soldier who had had his arm blown off above the elbow, had a perfectly comfortable upper arm stump until he applied for return to active duty. When this request was refused, he wanted to strike out with his amputated arm and clenched his missing fist. He then became aware for the first time of his phantom hand, which remained clenched and painful. Although several neuromas were resected from the amputation stump, the phantom sensation was not relieved. However, as soon as he accepted the fact that he could not return to duty and asked for retirement, with the understanding that he could probably go overseas as a Red Cross field director, the phantom pain disappeared. Evidence that this

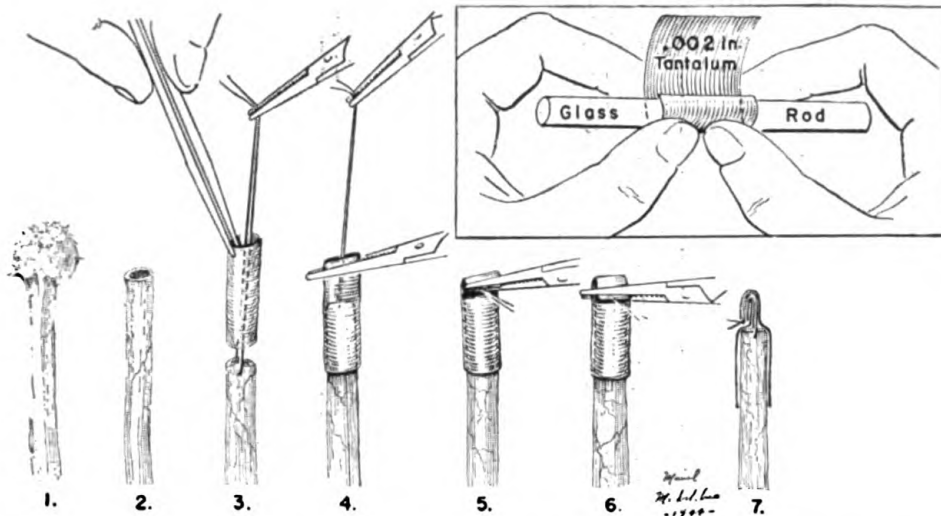
type of pain is often a central projection from the postcentral cortex has been summarized by Riddoch (8). Once this pattern has become fixed after prolonged physical and emotional disturbance, no interruption of the pain tracts can bring relief. It has been pointed out that the situation is similar to the tinnitus complained of by patients with Ménière's disease. This is usually cured by early section of the auditory nerve, but when it has been present for a long time it may persist, even though the attacks of explosive dizziness are successfully relieved.

TREATMENT

Despite our lack of a fundamental understanding of causalgia, postamputation neuralgia, and the painful phantom disturbances, several facts stand out clearly and require emphasis. Pain, considered by Hilton (9) and by Mackenzie (10) as a protective mechanism, may become a destructive force, dangerous to the serviceman's or veteran's morale. As pointed out above, when pain of this type is allowed to become chronic, the cerebral cortex



1. Prevention of neuroma formation by drawing cut end of nerve through drill hole in neighboring bone, as suggested by Boldrey (14).



2. Prevention of neuroma formation by covering stump of nerve with cap of thin sheet tantalum: 1. and 2.—Stump of nerve before and after resection of end-bulb neuroma. 3.—Close-fitting rolled sleeve of sheet tantalum is slid over end of nerve. 4.—The open end of the sleeve is crushed in a hemostat. 5.—The flattened end is bent back on itself, and crushed together in 6. and 7. The silk thread transfixing the end of the nerve secures the cap in position.

may become involved in its projection, so that no peripheral operation can relieve it; in addition, the patient usually develops an addiction for morphine. Watchful waiting, in the hope that the pain will disappear spontaneously, is therefore not advisable for more than a limited period—say, for 6 months in the most stable individuals. A definite plan of action is therefore needed and the following program is proposed to be undertaken when all conservative orthopedic, physiotherapeutic, and neuropsychiatric measures have been tried and have failed.

Before recourse to surgery, it is always essential to bear in mind that any ill-advised operation is likely to make the patient worse. McKeever (11) has observed that the pain in an amputation stump is usually increased by an operative procedure, such as simple revision of flaps, in which the nerve stumps are not even exposed. Progress has been made since the last war through the realization that certain procedures are useless and should no longer be considered. These include the repeated resection of neuromas, cutting or chemical blocking of nerve trunks by injection at higher levels, reamputation, periarterial sympathectomy, intrathecal injection of alcohol, and division of the posterior spinal roots. This has been discussed in detail in a previous paper (12). There are two simple procedures that are often helpful and involve little chance of making matters worse:

1. A single resection of a sensitive neuroma is distinctly worth trying, particularly if the hyperesthesia is localized and can be relieved by local infiltration of procaine. Formerly these neuromas reformed and pain recurred within a few weeks. Injection of the fresh nerve stump with alcohol does little to delay the re-appearance of the neuroma, but injection of 20-percent formalin is more effective (13). Boldrey's (14) suggestion of drawing the nerve end through a drill hole in a neighboring bone (fig. 1) is proving an effective method of preventing the reformation of a neuroma. At the U. S. Naval Hospital in Chelsea intercostal and digital nerves have been treated in this manner in four patients without further return of pain (table 1). Another technic used here which has been developed simultaneously by Major Barnes Woodhall at the Walter Reed General Hospital, is to cover the end of a nerve, from which a neuroma has been removed, with a snugly-fitting cap of thin sheet tantalum. This procedure is illustrated in figures 2 and 3, and appears to be most effective.

TABLE 1.—*Relief of local hyperesthesia by excision of neuroma modified by procedures to prevent reformation*

Patient	Condition	Surgical procedure	Relief
1. H. T. Pvt. USMC	Intercostal nerve caught in scar following gunshot wound. Neuralgic pain.	Intercostal nerve severed on entering scar and drawn through drill hole in rib.	Nearly complete freedom from former pain at 1 month.
2. H. J. CM 3/c USN	Traumatic amputation, distal phalanges 4th and 5th fingers. Local hyperesthesia and deep ascending neuralgia.	1. Plastic revision, poorly constructed 5th-finger stump, excision of neuromas, drawing digital nerves through drill hole in middle phalanx. 2. See table 2.	Relief of local hyperesthesia only, but persistent ascending neuralgia, and continued hyperesthesia in stump of 4th finger.
3. J. G. S 2/c USN	Traumatic amputation 2d and 3d fingers. Exquisite pain in stumps and aching through hand and forearm. Cold, cyanotic, sweaty hand.	1. Digital nerves of 3d finger freed from terminal neuromas, drawn through drill holes in proximal phalanx. 2. See table 2.	Relief of local hyperesthesia of middle finger, but no effect on deep ascending pain; index finger still hypersensitive at 2 months.
4. R. B. S 1/c USN	Severe scarring of sides of index finger by crushing accident. Local hyperesthesia of both sides of finger.	1. Paravertebral sympathetic ganglion block. 2. Amputation finger tip. Lateral digital nerve drawn through drill hole in proximal phalanx.	No effect on pain. Loss of hyperesthesia over lateral side of finger at 7½ months, with persistence of pain on medial side.
5. P. C. Sgt. USMC	Traumatic amputation, tip of 5th finger, with repeated amputations to metacarpal level for local hyperesthesia of stump and deep aching pain.	1. Resection neuroma from medial digital nerve, enclosure of stump in tantalum cap. 2 and 3. See table 2.	Relief of hyperesthesia only; no effect on underlying neuralgia at 4 months.

2. In patients with vasomotor and emotional disturbances, so commonly found in these painful states, much can be done by the elimination of the regional sympathetic outflow to the painful extremity. This can be accomplished either by repeated chemical

blocking with procaine or by sympathectomy. The technic of these procedures has been described by White and Smithwick (15).

The relief of pain, as stated previously, is not brought about by any interruption of afferent impulses, as these do not run in the peripheral sympathetic system, but by correction of abnormal circulation and interruption of sympathetic influences on the irritated sensory nerve endings. Evidence for this is that these patients are often more comfortable when protected from psychic stimulation (Doupe et al.) and during the reduction of sympathetic vasoconstriction which occurs in warm weather, or when circulation is improved after artificial fever induced in a hypertherm or during a malarial chill (Mayfield and Devine (16)).

By far the most practical clinical test is the paravertebral infiltration of procaine around the upper thoracic or lumbar sympathetic ganglia. Many favorable results have been reported by

TABLE 2.—*Interruption of sympathetic fibers for relief of local pain after amputation*

Patient	Condition	Surgical procedure	Relief
6. R. P.*	Amputation, crushed index finger, associated with cold, clammy hand; pain in hand radiating up inner arm to pectoral region.	1. Reamputation of finger. 2. Paravertebral procaine block T1-T2. 3. Cervicothoracic ganglionectomy.	None. 2 hours. Slight recurrence of pain 1 year after operation, on partial recovery of vasoconstriction and sweating.
7. R. L.*	Traumatic amputation, index finger, associated with cold, sweaty hand.	1. Reamputation. 2. Paravertebral procaine block T1-T2. 3. Cervicothoracic ganglionectomy.	None. Transitory. Permanent.
8. J. B.*	Burning pain developing in stump 30 years after thigh amputation; pain present 3½ years.	1. Section spinothalamic tract with sensory level at T12**. 2. Paravertebral lumbar procaine block. 3. Paravertebral lumbar procaine block. 4. Paravertebral lumbar procaine block. 5. Lumbar sympathectomy L1-L3.	Relief for 4½ months with recurrence following transurethral prostatectomy. Relief for 2 days. Relief for 4 weeks. Relief at discharge. Relief for 7 months, then partial recurrence.
2. H. J. CM 3/c USN	Traumatic amputation, distal phalanges, 4th and 5th fingers. Very cold, cyanotic, sweaty hands.	1. See table 1. 2. Upper thoracic preganglionic sympathectomy.	Warm hand and arm, free from deep pain after 3 weeks.
3. J. G. S 2/c USN	Traumatic amputation 2d and 3d fingers. Local hyperesthesia in 3d finger had been relieved by excision of neuroma, but without effect on neuralgia of hand and forearm.	1. See table 1. 2. Upper thoracic preganglionic sympathectomy.	Complete relief of ascending neuralgic pain. Patient still complained of hyper-sensitive index finger, but was able to return to limited duty.
5. P. C. Sgt. USMC	Traumatic amputation, tip of 5th finger, with repeated amputations to metacarpal level for local hyperesthesia and deep ache in hand and arm. Cold, cyanotic hands.	1. See table 1. 2. Procaine block of upper thoracic ganglia. 3. Upper thoracic preganglionic sympathectomy.	Relief for 2 hours. Nearly complete relief of deep aching pain in hand and arm at 3 months.

* Civilian case treated at Massachusetts General Hospital, Boston.

** Level of analgesia not high enough.

Leriche (17), Livingston (18), Homans (19), de Takats and Miller (20), and by Doupe and his collaborators. Sometimes long-lasting relief has followed a single or several repeated injections.

When pain is relieved during the period of sympathetic block, but reappears as the drug is absorbed, there is a very good chance that surgical interruption of the regional sympathetic ganglia will bring about lasting relief. Experience with six such cases is summarized in table 2. This method is most effective when the pain results from a nerve lesion in the lower arm or leg with associated vasospasm.

As sympathectomy produces no dramatic increase in circulation above the midforearm or midcalf, the improvement noted in one case (case 8), in which pain developed in a midhigh stump with arteriosclerotic changes 30 years after amputation, was a distinct surprise. Here the immediate result was excellent, but after 8 months is no longer satisfactory, due presumably to some further reduction in the circulation in the scar. In another case (case 5), that of a Marine sergeant with a painful fifth finger stump of 10 years' duration, sympathectomy has given only partial relief of deep aching pain, but the circulation in the hand is greatly improved and the patient grateful.

As sympathectomy is a very safe and nonmutilating procedure, it is held that it distinctly deserves consideration and trial when persistent pain in a peripheral nerve wound, amputation stump, or phantom limb is associated with evidence of abnormal vasomotor, sudomotor, or emotional manifestations, and particularly when the pain clears for several hours during sympathetic paralysis induced by paravertebral infiltration of procaine. The patient should then be told frankly that, while relief cannot be guaranteed, there is a distinctly better than even chance for a satisfactory outcome, and a certainty that the abnormal peripheral circulation will be stabilized. Impressive results from sympathetic denervation of extremities for intractable pain following nerve injuries in military hospitals in the present war have been presented by Doupe and his coworkers (3) and by Spiegel and Milowsky (21).

Examination of tables 1 and 2 suggests that the superficial hyperesthesia caused by injury to a nerve trunk can often be relieved if reformation of the neuroma is effectively prevented. On the other hand, deep aching pain which spreads proximally after injury to a peripheral nerve is not influenced by this procedure. However when this type of pain is accompanied by evidence of abnormal sympathetic activity, it is likely to respond well to sympathetic denervation. This operation, in turn, is without effect on



3. Roentgenograph showing tantalum cap in position over end of digital nerve after resection of neuroma (Case 5).

the cutaneous sensitivity overlying a neuroma, which is described above.

When these relatively simple and innocuous operations cannot be used, the surgical attack must be shifted to the central nervous system. Before recourse to more radical intervention on the

spinal cord or brain can be considered, all aspects of the problem should be reviewed with a competent neuropsychiatrist. Again it is important to remember that these operations are mutilating procedures. They may result in serious complications and, if they fail, will add another psychic trauma with further reduction of the patient's morale. Recourse to such radical surgery can therefore only be undertaken in desperate cases in which pain is so severe that the patient threatens to become an addict to morphine, a psychopathic problem, or a suicide.

Interrupting the anterolateral spinal (spinothalamic) tract by which painful impulses reach the brain is in general far more effective than cutting the posterior roots over which they enter the spinal cord. From personal experience to the present, it can be stated that pain and tenderness which are located within the stump itself can be relieved by cordotomy. Three typical cases are summarized in table 3.

TABLE 3.—*Section of spinothalamic tract for relief of local pain after amputation*

Case	Condition	Level of analgesia	Relief
9. W. D.*	Gritti-Stokes amputation for thromboangiitis obliterans, deep aching pain in stump, 3½ years' duration.	9th thoracic segment.	Until death 3½ years later. This patient had developed pain in stump of other leg after a second Gritti-Stokes amputation and painful gangrene of fingers; died after cervical cordotomy on opposite side.
10. N. T.*	Burning pain in stump since thigh amputation for osteomyelitis 8 years before; at other hospitals had had unsuccessful sciatic neurectomy, multiple excisions of neuromas and intrathecal alcohol injection; latter caused bladder disturbances for 1 year.	8th thoracic segment.	Complete relief at 3 months.
11. E. H.*	Midthigh amputation following septic abortion; local pain in stump of 2 years' duration; previous intrathecal alcohol injections had paralyzed bladder without mitigating pain.	10th thoracic segment.	Complete relief for over 3 years but has complained of radicular pain at level of laminectomy.

* Civilian patients operated upon at Massachusetts General Hospital, Boston, by various members of the neurosurgical staff.

In the case of severe phantom manifestations the decision as to whether relief can be obtained by spinothalamic tractotomy becomes most difficult. In the extensive experience of Bailey and Moersch (22) at the Mayo Clinic, this operation has failed consistently. Riddoch (8), however, is not pessimistic, although he points out that no relief can be expected when the pain has been stamped indelibly on the cerebral cortex. This means that a cordotomy performed without too long delay, and particularly before the patient becomes addicted to morphine, stands the best chance of success. Although it has not yet been proved, spinal anesthesia

should offer the best chance of weeding out the patient with pain of central origin following an injury to the lower extremity. In cases of arm pain procaine block of the brachial plexus can accomplish the same purpose, and it has been demonstrated that it does not relieve pain which originates in the cerebral cortex (Michelsen (23)).

TABLE 4.—*Section of spinothalamic tracts for relief of phantom limb pain after amputation*

Case	Condition	Level	Relief
12. C. W.*	Pain in phantom foot for 18 years following thigh amputation; 2 previous unsuccessful resections of neuromas.	Not recorded.	At 2½ years patient remains comfortable, although at times there is slight throbbing sensation in phantom little toe; spasmodic jumping of stump has ceased.
13. A. N.*	Crushing pain in phantom ankle following hip disarticulation for sarcoma 2 months previously.	7th thoracic segment.	In good condition and free from pain at 27 months, but has had awareness of phantom with some sense of stiffness in foot and big toe.
14. H. A.*	Pinching, burning pain in phantom foot 7 months after hip disarticulation.	9th thoracic segment.	Complete loss of phantom sensations at 8 months; still complains of spasmodic jerking of stump with sense of muscle cramp and of mild radiculitis at level of laminectomy incision.

* Civilian patients operated upon at Massachusetts General Hospital, Boston, by various members of the neurosurgical staff.

On the neurosurgical service at the Massachusetts General Hospital the spinothalamic tract was cut in 3 patients complaining of painful leg phantoms (table 4). It will be seen that the severe crushing or pinching pains in the phantom foot have been relieved in each instance. In the first patient (case 12), whose phantom sensations had been present for 18 years, it is remarkable that relief from pain should have been so complete. He writes: "No sensation to speak of in the missing leg, but some throbbing at times in the little toe and ankle bone. No movement of the foot or toes. The operation has also eliminated the spasmodic jumping of the stump to almost 100 percent."

The second patient (case 13) has had a sense of stiffness in his phantom ankle and big toe, but no pain. The third (case 14) states that he has lost all sense of his phantom, but that when the muscles of his stump contract he is still aware of the cramp-like sensation. This is not a sufficiently large series from which to draw definite conclusions, but it does prove that cordotomy can help in certain cases.

So far as can be ascertained, no successful cordotomy has been performed for phantom pain in the upper extremity, although the operation has been attempted three times by Grant (24) without success. For a high spinothalamic tractotomy the incision in the

anterolateral column is made at the second or third cervical segments, but it is not easy to raise the level of analgesia to the uppermost outflow of the brachial plexus. Much further surgical experience is required to establish the chances of successful relief of phantom pain. At present cordotomy appears to give this in about 50 percent of the reported cases, but when its use is strictly limited to those subjects in whom the pain can be relieved by preliminary injection of procaine, the percentage of effective results should rise to a more satisfactory level, at least in cases of lower extremity pain.

In cases in which pain is definitely of central origin, recent reports by de Gutierrez-Mahoney (25) (26) and Van Wagenen (27) have suggested that it can be attacked by resection of the sensory area in the postcentral cortex, or by frontal lobotomy (interruption of the frontal association fibers). The first operation removes the sensory cells which may give rise to the phantom sensation, whereas the second does away with the subject's introspection and concentration on his defect. Experience with these two operations is limited to 3 outstandingly successful cases, but they are based on sound theoretic grounds and should be of distinct value in the most severe and discouraging cases—patients who threaten, unless relieved, to deteriorate into hopeless invalids.

SUMMARY AND CONCLUSIONS

1. Painful neuromas, causalgia, and pain in phantom limbs occur most frequently in emotionally unstable persons with superimposed vasomotor disorders.

2. Pain is produced by partial or complete injuries of the nerve trunks, especially when there has been chronic sepsis and scar tissue formation around the point of nerve injury. Anoxia, abnormal vasomotor discharge, and other forms of sympathetic excitation of the hyperirritable sensory nerve endings appear to play a fundamental role in the production of pain.

3. In its most severe forms the pain, unless relieved at a relatively early date, will result in addiction to morphine and deterioration of the personality. Under these circumstances the pain pattern appears to become fixed in the cerebral cortex, so that no peripheral interruption of the sensory pathways can relieve it.

4. In treating difficult problems of this sort, the fact must always be borne in mind that any ineffectual and mutilating procedure, by adding another psychic trauma, must inevitably result in further suffering and loss of morale. Operations which fall in this category include repeated excision of neuromas, neurectomy,

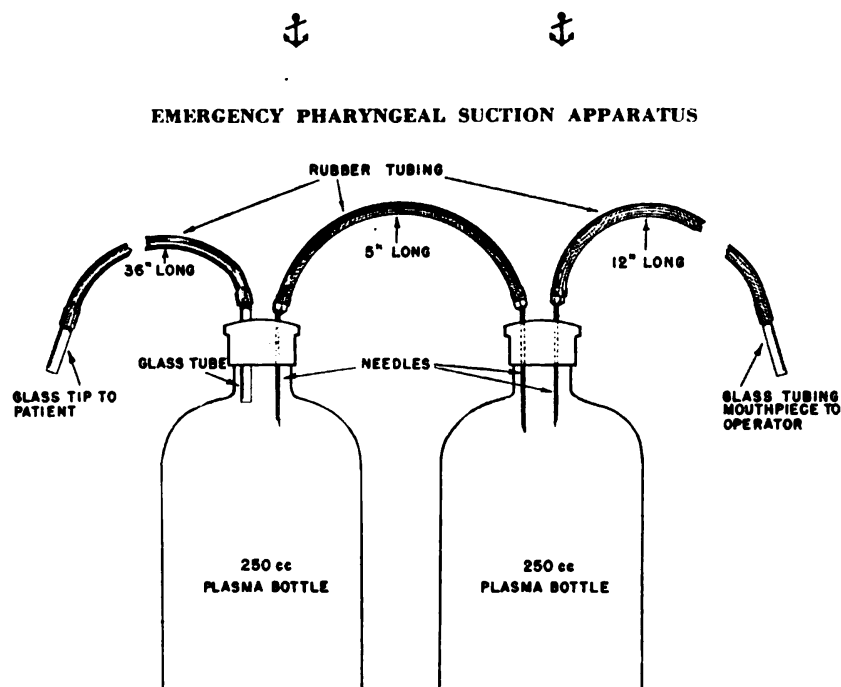
periarterial sympathectomy, reamputation at higher levels, and resection of the posterior spinal roots.

5. Operations which deserve a trial, and helpful points in their selection, are discussed.

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The illustrated emergency pharyngeal suction apparatus was constructed for a patient with a severe head wound resulting in bleeding into his pharynx, and subsequently used for patients in whom postural drainage was inadequate or impossible. The mechanism transmits negative pressure produced by the operator to an aspirator tip by means of two collecting bottles. All material for assembling the apparatus was salvaged from expended plasma sets. The unit is made from two 250-cc. plasma or distilled-water bottles with rubber stoppers, three lengths of rubber tubing 36, 12, and 5 inches long, three needles, and three pieces of glass tubing. The bottle arrangement permits maintenance of greater negative pressure and prevents any of the aspirated material from entering the tube leading to the operator.—CHRISTOPHERSON, J. E., Lieutenant (MC) U.S.N.R.

POSTTRAUMATIC URINARY SUPPRESSION— SHOCK AS A CAUSATIVE ENTITY

WITH A REVIEW OF THE RH FACTOR
AND REPORT OF CASES

H. L. PUGH
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This report is prompted by the fatal outcome in a group of eight patients under the author's supervision during the past 2 years. All of these patients died of uremia resulting from urinary suppression. They had all been subjected to trauma, either surgical or accidental, and the majority had suffered prolonged shock.

When a common clinical entity is present in a group of patients, the tendency is to try to incriminate a common causative factor. In this group the factor of shock was almost but not entirely a constant circumstance. The administration of parenteral fluids, particularly blood, was likewise an almost constant factor.

A review of the literature discloses that in relatively recent years, that is, since 1937, and especially from 1941 to 1944, out of a series of 49 articles on the subject of urinary suppression, 30 (references 1 to 30) deal with trauma as the cardinal causative factor, and almost without exception a particular type of trauma, namely, that sustained as a result of a crushing injury. Five of these reports (31) (32) (33) (34) (35) list blood transfusion as the cause of the urinary suppression.

That injuries due to crush and compression should have received so much emphasis since 1940 is explained by the fact that this type of injury was so common in England, particularly in London, incident to enemy bombings from the air. That urinary suppression should have been noted as a characteristic part of the crush syndrome is natural enough; however it does seem extraordinary that so much endeavor should have been made to ascribe this renal failure to some agent peculiar to a crush or compression injury as opposed to any other type of trauma. A great deal of difference of opinion exists upon this point and a great deal of controversy has arisen concerning it.

Certain writers have attempted to attribute anuria associated with crush injury to some specific substance, probably a proteo-

lytic agent, such as urea or myohemoglobin, produced by severely traumatizing muscle tissue. Eggleton (1) has shown experimentally on the cat that a substance toxic to the kidney can be extracted from the muscles of limbs which have been tightly bound for some hours, but not from normal muscle. In undamaged ischemic muscle, however, such a substance is said to occur. It is contended that the toxic material is some intermediate breakdown product. Case 1 of this series may speculatively be considered as belonging in this category.

Patey and Robertson (2) believe that a hemoconcentration occurs because of local spilling of plasma and tissue fluids. (Case 8 is a case in point.) Paramore (3) contended that the cause was not related to the manner in which the patient sustained the injury, but rather to the treatment which was being administered, namely, of flooding the system with parenteral solutions, particularly blood and plasma. Each school of thought admits that a turgescence of the kidneys and urinary suppression is an ultimate eventuality. (Cases 1, 2, 3, and 5.)

Although only 1 percent of oxygen is said to be consumed by the kidney in producing energy for its excretory function and the remainder is used in nonexcretory processes, the kidney is known to be extremely vulnerable to reduced oxygen supply. This reduction may occur as a result of: (1) A lowering of the systemic blood pressure, and (2) spasm of the renal vessels which is thought to occur from two causes, (a) reflex constriction and (b) a vasoconstrictor substance. The existence of a vasoconstrictor substance in renal ischemia associated with crush injuries is believed by Corcoran, Taylor, and Page (4) to be a very significant factor. These writers, moreover, support the contention that the obstruction of uriniferous tubules by casts of myoglobin is also particularly likely to occur in crush injuries.

Another significant observation made by Corcoran and his associates is that a condition of hyperphosphatemia is apt to be present when there has been considerable crushing of muscle tissue. The existence of phosphates in the blood tends to produce tetany. The addition of citrate may precipitate tetany in such a patient. It is, therefore, the recommendation of these investigators that 1 or 2 gm. of a calcium salt be administered when a patient suffering from a crushing injury is receiving a transfusion of citrated blood.

In the light of the observations made on this small series of cases, it seems reasonable to question all these views. It is the writer's belief that the principal contributing factor to anuria in crush injury is the same as that in any other type of injury,

namely, shock. (Cases 1, 2, 3, 5, and 6.) That crushing of muscles per se is any more apt to produce shock than is any other type of trauma seems to have been convincingly disproved by Prinzmetal, Freed and Kruger (5). Their work on dogs reveals that the element of infection is the determining factor in the production of shock from crush. This factor is probably a common one in the so-called delayed or secondary shock.

It is entirely understandable how a relationship between crush injury and urinary suppression came to receive so much emphasis. As has been said, nearly all of the early articles claiming this relationship appeared in the British literature and this was during or following a period when crush injury was exceedingly common in England incident to the great German air offensive. There was a circumstance closely related to this type of injury, however, which it seems reasonable to credit with a greater share of the responsibility for the kidney damage in these cases than the crush itself, and that is the time element associated with shock. It is well known that when the blood pressure drops below a certain level, the secretory function of the kidney ceases. Just what this critical level is, is not necessarily constant; it undoubtedly varies with different individuals. The kidneys of a young person are probably less exacting in their requirements regarding blood pressure than are those of older persons. In any event the blood circulating through the kidneys must circulate under appreciable pressure for the kidneys to secrete urine.

A fall in the arterial pressure of the general circulation below 90 mm. of mercury will, in the average person, produce a cessation of renal function, because as has been pointed out by Kasten (46), in a normal person the glomerular blood pressure is usually about 30 to 40 mm. below the systemic arterial pressure. When, as in severe shock, the blood pressure drops so low as to be unequal to the kidneys' requirements, there is a cessation of secretion, and a condition of renal anoxia supervenes. It is known that certain body tissues will tolerate a diminution or an absence of oxygen very poorly or for only a very short while. For example, the maximum time that the brain may be deprived of oxygen and still be capable of resuming normal function is 8 minutes. The exact tolerance of kidney tissue for a lack or absence of oxygen before irreversible changes take place is not known, but the interval is in all probability shorter than is realized, and we do know that the kidney is extremely vulnerable to reduced oxygen. Therefore as a result of low blood pressure the kidney suffers from anoxia and ceases to secrete. If the blood pressure is not restored to a reasonable degree within a reasonable time, the changes in the

kidney become irreversible and permanent, and death from anuric uremia becomes inevitable.

That the condition of deep and prolonged shock must have existed in a large percentage of the cases of crush and compression injury reported by the British is practically certain because of the circumstances under which the majority of these cases occurred.

The second factor which is regarded as a causative agent in a considerable number of cases of urinary suppression is that of blood transfusion. Ever since the first blood transfusion was given in 1667 (36) it has been realized that this measure was fraught with definite risks. Although the mortality rate from blood transfusions has been greatly diminished, due in part to Landsteiner for his discovery of hemagglutination in 1901, and to Jansky (37) and Moss (38) for their classification of blood groups; nevertheless it is still variously reported as from 0.1 to 0.5 percent. Hemoglobinuria has long been regarded as a fairly common accompaniment of blood transfusions. When present it may be indicative of renal insufficiency to a serious degree.

The syndrome of renal insufficiency resulting from blood transfusion has been adequately described in the literature. There has been some diversity of opinion, however, regarding the pathogenesis of this entity. In a comprehensive discussion by DeGowin, Osterhagen, and Andersch (31) the following cogent observations were made:

1. Many of the deaths following blood transfusion were apparently due to renal insufficiency.
2. This renal insufficiency was shown experimentally to be due to a blockage of the uriniferous tubules by crystals of acid hematin (case 7). Thus an intrarenal obstruction was produced.
3. The precipitation of acid hematin crystals occurs only in the presence of acid urine and can be obviated if the urine is kept alkaline. (Case 7 in the present series may belong to this category.)

This is only one way in which blood transfusions can produce serious complications and death; there are at least four others. One is failure properly to type and crossmatch the recipient's and donor's blood for hemagglutinins. Another is the failure to take into account the subgroups A and AB. Still another is the phenomenon of anaphylaxis. The term anaphylaxis is probably too loosely used in certain instances; nevertheless that a violent reaction and sudden death can occur from this type of hypersensitivity is an established fact and should be borne in mind. This type of reaction is, however, rare. In 1924 Lamson (47) reported 41 cases in which death occurred within from a few minutes to

a few hours following the injection of a foreign protein. The fourth principle upon which deleterious results from a blood transfusion may be based is relatively new. It had not been heard of 5 years ago, and although it is being freely referred to in the current literature, it is not widely understood. This principle involves the so-called Rh substance or factor. Since it is new and not well known, it would seem justifiable to review the salient facts pertaining to it at this time.

Landsteiner in 1901 discovered that human beings are, by reason of natural antibodies (hemagglutinins), divided into blood groups which have been designated by Jansky (37) and Moss (38) as groups AB, A, B, and O. In 1927 Landsteiner and Levine (39) described three other groups which they classified as M, N, and P groups. Specific antigens were discovered in the red cells but no corresponding antibodies were found in human serum. The only practical application claimed for this more definitive grouping is that identity of these cells is of value in paternity tests. In 1928 these same authors (40) described definite subgroups of A and AB. These are called A_1 , A_2 , A_1B , and A_2B .

However, in 1940 Landsteiner and Wiener (41) found that by injecting blood of rhesus monkeys into rabbits, a rabbit serum was produced which would clump the red cells of the monkey. Moreover it was found that this same rabbit serum would clump the red cells of 85 percent of human beings. This factor is known as the Rh factor or substance, and by use of immune rabbit serum it has been possible to differentiate human beings into two groups. Those who possess the Rh factor, that is, 85 percent, are classified as Rh positive (Rh plus). The remaining 15 percent who are devoid of the Rh factor are classed as Rh negative (Rh minus).

Reduced to simple terms the following considerations apply:

1. The factor is fixed to the red blood cells, probably as a carbohydrate fixed to the protein of cells and is not present in serum or plasma.

2. If an Rh-positive recipient receives a transfusion from either an Rh-positive or an Rh-negative donor, no untoward reaction occurs.

3. If an Rh-negative recipient receives a transfusion from an Rh-negative donor, there is no reaction in so far as the Rh factor is concerned.

4. If an Rh-negative recipient receives a transfusion from an Rh-positive donor, no reaction may occur in the original transfusion. However the antigens in the Rh-positive blood will, in the presence of Rh-negative blood of the recipient, stimulate the generation of antibodies and the Rh-negative individual becomes

sensitized, so that if a later Rh-positive transfusion is given, a violent, possibly a fatal reaction may ensue. The word "may" is used advisedly since, according to Smith and Wiener (42), only about 1 in 50, or 2 percent, of Rh-negative individuals becomes sensitized upon exposure to the antigen. It follows that since only about 1 in 7 is Rh negative, in practice an intragroup hemolytic reaction would occur only about once in 300 patients receiving repeated blood transfusions.

5. If an Rh-negative woman is married to an Rh-positive man and becomes pregnant, the Rh-positive factor is transmitted by the father to the fetus as a Mendelian dominant. This factor is passed by the fetus through the placenta into the maternal circulation, and antibodies are formed in the mother's serum which pass back through the placenta and hemolyze the fetal red cells, causing erythroblastosis.

6. An Rh-negative mother who bears an Rh-positive baby is sensitized by that pregnancy so that a subsequent transfusion of Rh-positive blood may produce a severe, even fatal, hemolytic reaction.

The practical application of the question of the Rh factor to anuria is based upon the premise that the marked hemolysis of transfused Rh-positive cells into an Rh-negative recipient may cause renal obstruction. Koucky (33) has expressly pointed out that, while it is customary to attribute oliguria or anuria occurring in association with Rh incompatibility to obstruction of the kidney tubules by hemoglobin, tubular degeneration similar to that caused by bichloride of mercury has been demonstrated. In fact necrosis of the whole cortex has been described, and inasmuch as cellular damage is a most prominent feature of erythroblastosis, it is reasoned that the cause for kidney failure in this type of transfusion reaction may very likely be due, in part at least, to cellular injury to the tubular epithelium of the kidney, rather than solely to obstruction of its tubules by hemoglobin. It has, moreover, been suggested by Koucky and others that because minor reactions are not reported, the percentage of severe or fatal reactions appears inordinately high in the cases reported in the literature.

That urinary suppression may result from an obstruction of the kidney tubules by sulfonamide crystals is well established. Also there appears to be fairly conclusive evidence that the secretory function of the kidney may be seriously impaired by an inherent sensitivity to sulfonamides (case 4). In this type of suppression, for want of a better term, we say that the mischief maker was of a reflex nature. Kidney failure belonging in this category is

mentioned here because of the fact that the sulfonamides are so commonly used in patients suffering from wounds of such magnitude as to be accompanied by shock, and also in connection with certain major surgical procedures.

Uremia from urinary suppression is a common cause of death in persons severely burned. The mechanism of urinary stoppage in such cases is probably never due to a single factor but rather involves several, including (1) hypotension incident to shock, (2) hemoconcentration from loss of fluids into the body tissues and from the burned surfaces, (3) a reduction in the circulating volume of fluid (the latter two factors have been pointed out by Gordon and Gordon (43), and (4) the deleterious effect upon the secretory epithelium of the kidney by toxic substances which are produced by the burn itself in addition to those consequent to a secondary breaking down of dead and infected tissue. Pack (44) has pointed out that this toxic substance produces an acute glomerulitis, and Turck (45) claims that the degenerative changes going on in the kidney causes venous stasis which induces further tissue breakdown (case 8).

The urinary suppression not uncommonly seen in the terminal stages of a patient suffering from peritonitis or other fatal entity may very probably be properly ascribed to toxic factors, and by this same token the uremia associated with crush injuries may in part be explained in terms of a similar toxic factor. This seems worthy of note, since the manifestations of secretory impairment of the kidneys in the majority of cases of crush injury reported in the literature have appeared after an appreciable lapse of time following receipt of injury.

There is yet another factor which it is believed constituted a very significant circumstance in several of the individual cases belonging to the present series of deaths from uremia. It is believed that four, if not five, of the eight patients in this series, if they had been encountered 10 years ago, or even today under conditions less favorable to the immediate availability of plasma, blood, oxygen, and other supportive measures, would have died in shock and would never have survived long enough to permit a determination as to whether or not they would manifest evidence of renal failure.

CASE REPORTS

Case 1.—This patient, 26 years of age, was pinned beneath a trailer and freight car which caused a compound fracture of his left femur. About 3 hours following the accident he very rapidly went into profound shock. He recovered from shock within 24 hours after administration of large quantities of plasma and whole blood, but shortly thereafter he developed a suppression

of urine from which he failed to recover despite administration of large quantities of fluid and other prescribed measures. He died 5 days following injury. Postmortem examination revealed cloudy swelling of the liver and kidneys.

Several factors might have contributed to the urinary suppression in this case, namely, (1) shock, prolonged and profound, (2) blood transfusion, or (3) a crushing injury. Whether, as has been claimed by several writers, certain substances peculiar to injuries in which a large amount of muscle tissue is crushed acted as a renal inhibitor in this case is speculative. That this patient would very probably have died of his original injury and the resultant shock had it not been for the institution of certain effective means for reclamation now at our disposal must also be taken into consideration.

Case 2.—A 38-year-old woman with moderate hypertension (178/110) had a supracervical hysterectomy with bilateral salpingo-oophorectomy. Spinal anesthesia with 50 mg. procaine and 10 mg. pontocaine hydrochloride was used. The patient appeared to be under heavy sedation postoperatively, and in about 10 hours she suddenly passed into a deep coma. She appeared moribund and was thought to have had a cerebral accident. The blood pressure dropped to 70/50; the pulse was perceptible and not of particularly poor quality. A venous section was done in order to introduce a needle for administration of parenteral fluids. The patient received blood, plasma, and whole blood. The blood pressure, however, did not return to nearly normal until 10 cc. of an adrenal cortex preparation had been given.

From 1530 on the day of operation until 1000 the following day, the patient received 6,075 cc. of fluid intravenously as follows: 3,075 cc. of 5-percent dextrose, 1,000 cc. in normal saline solution, the remainder in distilled water; 2,500 cc. of blood plasma, and 500 cc. of whole blood. The urinary output in this period was 835 cubic centimeters. During the second 24 hours postoperatively, sodium lactate was administered intravenously in amounts sufficient to alkalinize the urine.

The patient regained consciousness and appeared clinically to be improved; however the urinary output remained greatly diminished and the patient's course was steadily downward. A paravertebral sympathetic nerve block was done on the twelfth dorsal and first lumbar nerves, right and left side, as advocated by Peters (48). Ten cubic centimeters of 1-percent procaine was used on each side at the level of the twelfth dorsal vertebra, and 20 cc. on each side at the level of the first lumbar vertebra. The blood pressure before blocking was 202/140; immediately after nerve block, it fell to 160/100.

The urinary output was not appreciably affected, but there were progressive signs of uremia. The specific gravity of the urine was from 1.010 to 1.006. The reaction alkaline after sodium lactate had been administered, the albumin 2 or 3 plus. Nine days postoperatively blood studies showed the nonprotein nitrogen to be 222, the chlorides 514, creatinine 9.4, and the blood urea nitrogen 141 milligrams percent. The following day the patient died. Postmortem findings included evidence of abdominal ascites and pleural effusion, apparent edema and atelectasis of the lungs, hypertrophy and dilatation of the heart, changes consistent with bronchopneumonia, and cloudy swelling of the kidneys.

In this case the urinary suppression was probably due to an anoxia of the kidneys beyond a critical degree and for a period in excess of the critical. The patient may be said to have suffered secondary postoperative shock. An explanation for the desperate state into which the patient lapsed on the first postoperative night was never definitely determined.

Case 3.—This 22-year-old patient sustained a stab wound in the back as a result of a brawl. He had bled excessively and was still bleeding at the time of arrival at the hospital. The blood pressure was 70/40. During the night he was given 1,000 cc. of whole blood and 1,000 cc. of plasma, and the blood pressure fluctuated between 60/20 and 70/30. During the morning and again on the evening of the following day the patient received 1,000 cc. of 5-percent dextrose in normal saline solution with 10 cc. of an adrenal cortex extract in the solution. The blood pressure remained 60/40.

Twenty-four hours after admission the patient was given a second 1,000-cc. whole-blood transfusion. He appeared better the next day but the blood pressure remained low until about midnight, 48 hours after admission, when it rose to 128/74. The urinary output was scanty from the time of admission but became alarmingly low during the third day, and the patient rapidly assumed the appearance of one dying of uremia. The temperature remained normal. His urine was acid. He died 4 days after admission. On the day of death the blood chemistry had been reported as follows: Creatinine 7.1, chlorides 422, nonprotein nitrogen 194 milligrams percent, and the carbon dioxide combining power 57 volumes percent.

The postmortem findings were summarized as wound, punctured, left shoulder; hemorrhagic infiltration, traumatic, brain (there was no clinical evidence of an intracranial injury); changes consistent with meningitis, cerebrospinal, acute (staphylococcic); apparent dilatation, cardiac, acute; evidence of pleural effusion; edema, congestion and infarction of the lungs; abrasions, right hand; contusion, left temporal area; and cloudy swelling of the kidneys.

Causes of urinary suppression in this case are considered to have been: (1) Shock (in all probability the paramount cause); (2) blood transfusion with probable blockage of the kidney tubules with acid hematin; and (3) the element of his having reached a state which rendered him beyond reclaim seems worthy of consideration. He had lost an essential and irretrievable vital spark.

Case 4.—A 23-year-old male patient, following an appendectomy, was found to have regional enteritis and received sulfathiazole, 1 gm. every 4 hours for 1 week postoperatively.

One month after operation a resection of 12 inches of ileum and the right half of the large bowel and an ileotransversostomy were done. The temperature shot to 105.4° F. during the first 5 postoperative hours; the pulse rate varied from 130 to 140 beats per minute and the patient complained of abdominal pain. He was thought to be developing peritonitis, and sulfathiazole therapy was resumed. Urinary suppression developed and the patient rapidly assumed an appearance commonly associated with an agonal state. He had been given 500 cc. of plasma and 500 cc. of whole blood the day prior to

developing urinary suppression. Notable features were the markedly elevated temperature and accelerated pulse rate. The blood count remained close to normal. The leukocytes numbered 10,600 per cu. mm. with 15 percent band forms, 58 percent segmented cells, and 22 percent lymphocytes on the day prior to death, which occurred on the fifth postoperative day.

Postmortem examination revealed enlarged kidneys, but there was no demonstrable evidence of sulfathiazole crystals within the kidney tubules.

It is believed that a hepatorenal syndrome, described by Heyd (49) may have existed in this instance. That the necropsy may fail to reveal why a fatality has occurred in such cases has been pointed out by Boyce (50), and that biliary tract surgery is not prerequisite to the hepatorenal syndrome has been recognized by several observers, notably Garlock and Klein (51). A reflex suppression of urine due to sulfonamide sensitivity is offered as a theoretical cause for the urinary failure in this case.

Case 5.—A male patient, 50 years old, had a partial gastrectomy, and on the morning of the first postoperative day was found to have lapsed into shock. The blood pressure was 60/40. He was immediately given transfusions of 1,000 cc. plasma and 500 cc. of whole blood. Following this his blood pressure rose to 110/52 and remained at about that level. The patient had voided 300 cc. of urine prior to going to the operating room. However, following treatment for shock, his urinary excretion became progressively less until the last 24 hours of his life when it was only 27 cubic centimeters. The blood chemistry studies revealed findings typical of a uremia. The urine was acid in reaction. The patient died on the fourth postoperative day.

Postmortem examination revealed infarcts of the spleen, and both kidneys were three times normal size and presented an appearance as if they had been parboiled.

The flooding of this patient's vascular system with blood and plasma may have been a factor in the production of the ensuing anuria. The blockage of the uriniferous tubules by acid hematin crystals may also have been a possibility. However the fact that the patient lapsed into a severe state of shock and was inadvertently permitted to remain in this state for an excessive period is sufficient to explain the subsequent urinary suppression.

Case 6.—After this 34-year-old patient had a cholecystectomy, there was excessive bleeding. The patient had a chill on the table, and his condition became poor. Five hundred cubic centimeters of whole blood was administered. The abdomen was reopened 8 hours after the original operation and the bleeding gallbladder bed was packed with gauze. Bleeding was stopped.

The blood pressure had remained around 60/40 throughout the day. On the first postoperative day the patient's condition was considered improved. On the second day, however, he had two convulsive seizures during the night. The packing was removed the following morning. He had another convulsion during the day. He received several blood transfusions, and developed urinary suppression which failed to respond to all measures. His blood pressure was

130/60 on the day of his death, 3 days postoperatively, and the laboratory blood studies were reported as follows: Nonprotein nitrogen 133, urea 72, chlorides 545, creatinine 8.4 milligrams percent, and the carbon dioxide combining power 72 volumes percent. The white blood cells numbered 22,000 per cu. mm. of whole blood. The reaction of the urine was acid. The patient received sulfathiazole, 6 gm. every 24 hours postoperatively, and on the day prior to his death the sulfonamide blood level was checked at 26 mg. per 100 cubic centimeters. This elevation was undoubtedly due to failure of urinary output.

It is believed that the cause of death in this case was uremia resulting from a renal suppression due to shock, irreversible changes in the kidneys, and blood transfusions.

Case 7.—Following cholecystectomy on a 35-year-old patient, convalescence was complicated by a paralytic ileus. On the fifteenth postoperative day his body chemistry became markedly disturbed. Urinary suppression followed, and death supervened almost 1 month following cholecystectomy. Urinary suppression was succeeded by retention of nitrogenous waste products and reduction of blood chlorides. The blood nonprotein nitrogen was 150, the urea 88, and chlorides 330 milligrams percent.

He was given a large amount of intravenous fluids, some concentrated plasma, blood transfusions and saline infusions. The blood chlorides became slowly elevated. Urinary suppression followed the free use of plasma and whole blood. The nonprotein nitrogen of the blood rose to 234, the blood urea to 166, creatinine to 7.4, and chlorides to 416 milligrams percent, and the carbon dioxide combining power to 50 volumes percent. The reaction of the urine was acid. Temperature, pulse rate and respirations in this patient were not appreciably altered. The icterus index rose to 6.8 following blood transfusions.

Postmortem examination revealed parenchymatous degeneration of the liver and kidneys.

It is believed that the urinary suppression in this case could have been due to the blockage of the uriniferous tubules by acid hematin crystals following blood transfusions.

Case 8.—A patient, 22 years of age, was admitted to the hospital with extensive second- and third-degree burns sustained when an airplane of which he was the pilot broke into flames upon forced landing. It was extremely difficult to administer parenteral fluids to this patient because of the burned condition of his arms and other common sites for venipuncture. However by employment of the intrasternal route it was possible to administer adequate fluids, including a liberal amount of plasma and albumin, and in addition there was free oral intake. The patient's elimination of urine was greatly diminished from the outset, and although it improved for several days, it never approached normal before it ceased almost completely.

The patient proceeded to manifest the clinical and laboratory picture commonly associated with uremia and died on the eighth day following his injury.

The factor of toxemia undoubtedly constituted a principal cause for urinary suppression in this case.

SUMMARY

1. Urinary suppression as related to accident or operative trauma is discussed.
2. The several factors believed to play a leading role in the cause of anuria are individually considered.
3. The Rh factor is reviewed.
4. The dominant part played by anoxia, which is a natural consequence of the impaired circulation from hypotension attendant upon shock, is stressed.
5. The importance of prevention or the early recognition and treatment of shock is emphasized.
6. The loss of an irretrievable vital spark is suggested.
7. Eight cases in which death was due to urinary suppression associated with trauma of one form or another are reported.

CONCLUSIONS

In conclusion it is accepted that traumatic anuria or post-traumatic urinary suppression may be contributed to by a number of factors. Among these may very well be:

1. The blockage of uriniferous tubules by myohemoglobin.
2. The action of a specific vasoconstrictor substance.
3. Increased blood viscosity.
4. A decrease in blood volume.
5. The formation of acid hematin crystals associated with blood transfusion.
6. Cellular injury to the kidney by reason of Rh factor dyscrasia.
7. A neurogenic or reflex factor.
8. A toxic factor.

Regardless of how significant or insignificant a part the foregoing factors may be capable of playing, in the majority of cases in the series herein reported the cause of death is held to have been renal anoxia resulting from arterial hypotension incident to shock of lethal degree and duration. It naturally follows, therefore, that the early recognition and the prompt treatment of shock in such cases is the all-important consideration.

Moreover the stand is taken that a great deal of the literature upon the subject of traumatic urinary suppression, in which an effort is made to brand as a causative factor some special agent or entity, is incongruous and nonvalid. While it may be true that in a considerable number of cases the answer to what caused the patient's kidneys to fail must be found in physiology, in a number

of others, certainly, the answer is shock, either alone or together with other factors.

Further it is believed that whether the causative entity in this shock is a crushing injury, stab wound, surgical operation, burn, or any other form of trauma, makes little, if any, difference.

And finally it is difficult to gainsay that the loss of a vital spark, which as yet we are powerless to replace, played an important role in the majority of the cases in the series here recorded. In all probability it is a genuine and prominent factor in a great many similar cases. We can, at most, only postpone the inevitable outcome. Moreover because it has become possible, by reason of modern resuscitative and supportive agents and measures now at our disposal, for us temporarily to hold imminent death in abeyance, we may, in certain cases, observe processes of dissolution we have heretofore not been accustomed to see. Once an irreversible mortal state has supervened in any of the vitally essential physiologic systems, death is inevitable, and one of the systems most prone to assume such a state is the secretory system of the kidney.

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NEW TREATMENT OF MIGRAINE

An adjunctive procedure for the treatment of selected cases of migraine, consists in periarterial infiltration of the affected vessel with eucupine and procaine hydrochloride. Experience and clinical observations seem to indicate that the results are beneficial.—PATZER, R.; DERBES, V.; and ENGLEHARDT, H.: Periarterial infiltration in diagnosis and treatment of migraine; experimental and clinical experiences with eucupine and procaine hydrochloride. *Arch. Surg.* 50: 296-300, June 1945.

HEALTH OF LIBERATED NAVAL PERSONNEL

REPORT FROM LUZON

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Following recapture by American forces of large areas of western Luzon, including the city of Manila, 650 Naval personnel who had been stranded here since December 1941 were examined to determine their fitness for active duty. At that time there had been officially 1,060 men in this Naval district, of whom 200 were American, a small number Chinese, and the rest Filipino. By April 1945, some 410 of them (38 percent) were missing; most of these presumably died in combat or from disease. Of the survivors, 316 (48 percent) had been prisoners of war in Japanese concentration camps, where they suffered from various diseases and severe dietary privations.

Their ages varied from 19 to 63 years, with an average of 39½ years. The average period of internment for the prisoners was 3 months, during which time the average weight loss was 11.2 pounds. The loss of weight for the others was comparatively nil. The average weight for the entire group was 122 pounds, which is somewhat below that of an average-size Filipino male. It is thus apparent that those imprisoned were not kept on sustaining rations; this will be discussed further.

The past medical histories of these men were considered mainly since December 1941, and proved most significant in the imprisoned group. Malaria was the commonest disease contracted, 229 (72 percent) having contracted it while imprisoned at Camp O'Donnell at Capaz in the Province of Tarlac. Malariologists report estivo-autumnal (*Plasmodium falciparum*) malaria highly endemic for this area. Many men undoubtedly had had malaria prior to their imprisonment. Nevertheless a recurrence of the disease without treatment was in itself ravaging. All patients

with a history of the disease had malaria smears taken and no parasites were found.

Thirty-two of the imprisoned group gave a history consistent with beriberi. Seventy-nine (25 percent) had had dysentery. The causative agent was not established but quite likely was bacillary in type, for only three patients of the entire group were found to have *Endamoeba histolytica* in routine stool examinations. Dengue was contracted by six of the group. This low figure is possibly due to acquired immunity. More likely the history in each instance would have been more accurate if it were not for language difficulties. Sixty-nine (10 percent) of all personnel stated they had had syphilis at some time. All cases except one were acquired prior to December 1941. This disease will be discussed separately.

PHYSICAL FINDINGS

Table 1 lists the various defects noted on physical examination in prisoners and nonprisoners combined (650 men). Many of the findings were insufficient to be in themselves disqualifying from active duty.

TABLE 1.—*Defects found on physical examination of 650 men*

Condition	No. of cases	Percentage	Condition	No. of cases	Percentage
Pes planus.....	163	25.0	Palpable spleen.....	8	1.2
Visual defects.....	109	16.0	Pilonidal cyst.....	7	1.1
Hemorrhoids.....	90	13.8	Corneal opacity.....	7	1.1
Varicose veins.....	85	13.1	Auditory defects.....	6	0.9
Pterygium.....	80	12.0	Anal fistula.....	6	0.9
Scabies.....	79	12.0	Palpable lymphadenopathy.....	4	0.6
Arcus senilis.....	78	12.0	Hallux valgus.....	4	0.6
Varicocele.....	65	10.0	Goiter.....	3	0.5
Hypertension.....	29	4.5	Dermatitis, unclassified.....	3	0.5
Pulmonary pathology.....	18	2.8	Deficiency disease.....	2	0.3
Hernia, inguinal.....	15	2.8	Impetigo.....	2	0.3
Skeletal deformity.....	14	2.2	Arteriosclerosis.....	2	0.3
Cardiac pathosis.....	13	2.0	Absence of testicle.....	1	0.15
Tropical ulcer.....	12	1.85	Phimosis.....	1	0.15
Palpable liver.....	11	1.7	Jaundice.....	1	0.15
Malnutrition.....	10	1.5			

The most interesting finding was the presence of pulmonary pathologic changes. Eighteen (2.8 percent) were found to have evidence of active pulmonary tuberculosis. This percentage is lower than that for the general population of this region. When x-ray facilities are available, the number found may be higher. According to Francisco,¹ the incidence of adult pulmonary tuber-

¹ FRANCISCO, S. A.: Tuberculosis incidence in Philippines as revealed by x-ray and effective preventive measures against the disease. *J. Philippine Islands M. A.* 17: 63-82, February 1937.

culosis for this area during the period from 1933 to 1937 was 6.118 percent. This figure was arrived at by fluoroscopic examination of 20,000 unselected adults in the city of Manila and nine nearby provinces. The highest incidence was among the age group from 20 to 40 years, which corresponds with the age group in the examined personnel. In a personal interview with Dr. Francisco his unpublished findings on 699,648 persons examined from 1939 to 1941 were obtained. For the over-all period, the evidence of activity was 6 percent.

Since the beginning of the war, 102,000 examinations have been made, disclosing the startling incidence of 17.4 percent.² In Francisco's opinion this increase is attributable to (1) undernourishment; (2) trauma as a result of physical punishment by the Japanese; (3) lowered body resistance brought about by war (forced evacuation, lack of medical facilities, and poor general living conditions); and (4) the Japanese failure to maintain pre-war standards in tuberculosis control work.

Syphilis.—Sixty-nine (10.6 percent) gave a history of having had this disease. Accurate evaluation of this problem is difficult, as the health records have been lost. One patient had a primary lesion, verified by darkfield examinations. Additional studies are indicated in all, inasmuch as only 20 had a spinal fluid examination and none have had serologic examination since December 1941. In general the average length of treatment was 4 courses, given according to Navy routine, which was apparently adequate. Only two had evidence of active central nervous system disease.

Avitaminosis.—There were three cases of deficiency disease. Two of the men had beriberi, and the other had an atrophic tongue, cheilitis, and the subjective complaint of paresthesia of the hands and feet.

Casualties.—Forty-five (7 percent) had combat wounds. Eight were incapacitating. At this rate 1 percent of the personnel was lost for further usefulness to the Navy as a result of combat wounds.

Rejected personnel.—This term is used to designate all personnel who were disqualified from active duty, whether their rejection was temporary or permanent in nature. One hundred ninety-seven (30 percent) were rejected. Table 2 lists the causes. Many were found to have more than one disqualifying condition. Of the group rejected, it is estimated that after proper treatment one-third will eventually be fit to return to active duty.

² FRANCISCO, S. A.: Prevalence of pulmonary tuberculosis among Philippine government employees. *Rev. filipina de med. y farm.* 29: 105-113, March 1938.

TABLE 2.—*Causes for rejection*

Condition	No. rejected	Condition	No. rejected
Scabies.....	79	Dermatitis, unclassified.....	3
Albuminuria.....	36	Amebiasis.....	3
Hypertension.....	29	Goiter.....	3
Visual defects.....	22	Malnutrition.....	3
Pulmonary pathosis.....	18	Skeletal deformity.....	2
Hernia, inguinal.....	15	Enlarged liver.....	2
Cardiac pathosis.....	13	Central nervous system syphilis.....	2
Glycosuria.....	10	Beriberi.....	2
War wounds, incapacitating in nature..	8	Impetigo.....	2
Tropical ulcer.....	9	Arteriosclerosis.....	2
Strongyloidiasis.....	7	Bone tumor (finger).....	1
Defective hearing.....	4	Primary syphilis.....	1
General lymphadenopathy.....	4	Jaundice.....	1
Anal fistula.....	3	Deficiency disease.....	1

NUTRITIONAL STUDIES

Each man was interviewed as to his diet while imprisoned and since being released. The foods regularly eaten are listed in table 3. It is obvious that this at best is not a well-balanced diet.

TABLE 3.—*Foods eaten regularly*

Foods generally eaten daily		Foods eaten twice weekly	
Fish	Polished rice or other cereals	Meat (pork)	Mango
Sweet potato (camote)	Kangkong (vegetable)	Papaya (fruit)	Lanzones (fruit)
Camatis (tomato)	Bananas	Kalamansi (fruit), other fruits in season	
Mongo (beans)			

The diet of the masses in the Philippines consists largely of rice and is deficient in fat and proteins, but except for the low amount of vitamin B₁, the other vitamin intake is adequate. Beriberi is a common disease among those who live on this diet without supplemental sources of vitamin B₁. Rice oil from bran also contains the fat-soluble vitamins A and E. Contrary to general belief, coconut oil, which is eaten infrequently, does not contain vitamins A, D, or E.

Manatok and Valenzuela report an increasing use of avocados in the diet. This was not found true of the personnel interviewed by us. The avocado contains 1 percent fat and 5.6 percent protein and is rich in vitamins A, D, and E. Vitamin C is readily obtained from camatis (tomato). This food is available throughout the year.

Under normal conditions, therefore, Filipinos live upon a diet inadequate in protein, fats, and vitamin B₁. The 316 personnel imprisoned were those men captured at the time of the fall of Bataan and Corregidor in May 1942. They were immediately

taken to Camp O'Donnell and released after 4 months. During imprisonment their daily rations consisted of camote leaves, kangkong, and unpolished rice. No scientific information is obtainable on the accurate food value of either camote leaves or kangkong. The latter is a green leafy vegetable similar to spinach, with small leaves and a pulpy stalk. Unpolished rice was served in amounts varying from 50 to 75 gm. at the most each day, affording no more than 500 calories per day. The average monthly weight loss on this ration was 3 pounds.

The majority of the prisoners developed beriberi or contracted malaria or dysentery, or all three. Because of these debilitating illnesses the prisoners were of no use to the Japanese, and were released to seek refuge in outlying provinces. Evidence of malnutrition and avitaminosis persisted among the surviving personnel. The cost of food was high and many spent their entire fortunes upon food in order to survive.

Thirty-two prisoners gave a history of beriberi. It is quite likely that many others had it in a degree not recognizable as such. Further explanation for such a small number is the fact that their period of imprisonment was short, and that they were given unpolished rice, which gave them some protection even though it was served in inadequate portions.

LABORATORY FINDINGS

Urinalyses and stool examinations were made routinely on each applicant. Urines were analyzed by the Roberts and the Benedict tests, and stools by inspection of simple saline emulsions, using as many as two or three preparations when necessary.

The plus-or-minus group (table 4) comprises those urines with the least possible trace of albumin; table 5 indicates those with only a green turbidity after boiling.

TABLE 4.—*Albumin in urine, 508 examinees*

Results	Prisoners	Percentage	Non-prisoners	Percentage	Total	Percentage
Negative.....	237	80.4	194	91.4	431	84.9
±.....	25	8.5	10	4.7	35	6.9
+.....	21	7.1	8	3.8	29	5.2
++.....	8	2.7	1	0.5	9	1.8
+++.....	4	1.4	0	0.0	4	0.8
++++.....	0	0.0	0	0.0	0	0.0
Total.....	295	100	213	100	508	100

No attempt has been made to correlate these results with clinical findings. The rate is twice as high in prisoners as in non-prisoners; an even greater disproportion obtains with the sugar-

positive urines (table 5). No literature is available to afford comparison with the findings in a peacetime Filipino population. Whether an undiscovered tuberculosis accounted for any of this albuminuria is purely speculative. No roentgenographs were taken and no guinea pigs for inoculation were obtainable in this area.

TABLE 5.—*Sugar in urine, 504 examinees*

Results	Prisoners	Percentage	Non-prisoners	Percentage	Total	Percentage
Negative.....	266	90.5	202	96.2	468	92.9
± (green).....	6	2.0	6	2.9	12	2.4
±.....	11	3.7	2	0.9	13	2.6
++.....	11	3.7	0	0.0	11	2.2
+++.....	0	0.0	0	0.0	0	0.0
++++.....	0	0.0	0	0.0	0	0.0
Total.....	294	100	210	100	504	100

The incidence of helminthiasis (table 6) was found to be substantially lower than in rural Filipino populations, where the rate of infection is often over 90 percent for all three commoner roundworms. The low incidence of hookworm in this area has been attributed to the presence of clay rather than sandy soil. (This does not, however, explain the low incidence of trichuris.) A comparison with contemporary rates among local Filipinos is afforded by the findings in a series of civilian applicants for galley or mess-hall work, as shown in the table.

TABLE 6.—*Helminthiasis in 434 recovered personnel and 138 civilians*

	Prisoners		Nonprisoners		Combined civilian applicants			
	No.	Per-centage	No.	Per-centage	No.	Per-centage	No.	Per-centage
Positive.....	166	66.9	155	83.3	321	74.0	91	65.4
Negative.....	82	33.6	31	16.7	113	26.0	48	34.5
With ascaris.....	154	62.1	145	78.0	299	68.9	77	55.4
With trichuris.....	54	21.4	58	21.2	112	25.8	38	27.6
With hookworm.....	11	4.4	9	4.8	20	4.6	10	7.2
Ascaris only.....	105	42.3	88	47.3	193	44.5	47	33.8
Ascaris and trichuris.....	41	16.5	48	25.8	89	20.5	23	16.5
Trichuris only.....	7	2.8	6	3.2	13	3.0	11	7.9
All three.....	5	2.2	4	2.2	9	2.2	3	2.2
Hookworm only.....	1	0.4	2	1.1	3	0.7	2	1.5
Ascaris and hookworm.....	4	1.6	2	1.1	6	1.4	4	2.9
Hookworm and trichuris.....	1	0.4	1	0.5	2	0.5	1	0.7
Strongyloides.....	2	0.8	0	0.0	2	0.5	0	0.0
Total.....	248	100	186	100	434	100	139	100

The ascaris and trichuris rates were appreciably lower among the prisoners (62 percent and 21 percent) than among the non-prisoners (78 percent and 31 percent respectively). This is the opposite of what one would expect. Sanitation at the Tarlac camp

was very bad, promiscuous defecation was widespread, and with these conditions, plus crowding, many reinfections and cross-infections may have taken place. Since the average life span of an adult ascaris is thought to be about 1 year, probably relatively few initial infections occurred during the 3-month period. Perhaps the lower rate among the prisoners resulted from starving out of the worms or reduction to a state in which the females were no longer capable of egg laying.

Among all the stools examined, *Endamoeba histolytica* was found in only three (0.56 percent). Two had cysts, one trophozoites. Since the stools were examined simultaneously for both ova and amebae, with special attention to the former, it is unlikely that this low figure can be considered reliable. No *Balan-tidium coli*, *trichomonas*, *giardia*, or *chilomastix* was recorded.

DENTAL ASPECTS OF THE EXAMINATION

This phase of the examination was, of necessity, based on gross findings with a minimum armamentarium, namely, mouth mirrors and explorers. X-ray facilities were not available.

It is regrettable that a comparable age group of civilians, both male and female, could not have been examined at the time as controls.

There was a total of 16,226 teeth seen, with an average of 25 teeth per patient, and 1,361 fillings were found, 355 of which needed immediate replacement. Filling materials found included 800 fillings of gold (92 percent gold crowns), 49 of alloy, and 64 of silicate cements. Seventy-five percent of the total fillings were judged to be in acceptable condition.

The fact that the entire group averaged only two fillings per patient would seem to indicate that, by and large, the native Filipino has well-shaped, well-arranged and completely calcified teeth. Additional support for this statement might be obtained from the fact that only 1,071 new cavities were revealed by mouth mirror and explorer examination, or an average of 1.8 cavities per patient, in spite of the rigors imposed by 3 years of Japanese occupation. However 521 teeth were in need of immediate extraction.

Full upper and lower dentures were found in 13 instances; 9 of these were made of acrylic material and 4 of rubber. The average condition and serviceability of these dentures were good despite inadequate cleansing facilities. Twelve of these dentures had been constructed by Naval prosthodontists prior to December 1941.

Three removable bridges (one lingual bar, and two palatal bars) were found. They, too, were serviceable and of Navy construction, combining gold and acrylic denture material. A number

of patients reported being dispossessed of bridgework, both of the fixed and removable type, while in prison camp. One hundred two patients were found to be in immediate need of prosthetic service before they could be classed as dentally fit for return to active duty.

In the pathologic and clinical findings, intermediate and mild scattered areas of gingivitis, occasional pyorrhea pockets, and indefinite histories of other manifestations of deficiency disease were not included.

One case of sprue was recognized by the "beefy," glazed, sore tongue. Leukoplakia was present in one patient. It was learned that this patient habitually chewed betel-nut pulp and carried the "cud" in the vestibule at the site of the patches in the molar area. This was borne out by the actual presence of the "cud" in the right cheek when the patient was seen.

Two patients with beriberi also showed oral manifestations of scurvy, with characteristic looseness of teeth, swollen, spongy gums with hemorrhages, and small ulcerations apparently beginning between the teeth.

There were 38 cases of Vincent's stomatitis, as determined by the characteristic fetid odor and the presence of the pseudomembrane, and 53 cases of acquired hypertrophic gingivitis, differentiated arbitrarily from other forms by the degree and the extent of the infection.

Advanced pyorrhea alveolaris was found in 68 instances. Only those cases were so classed which were obviously beyond the corrective stage, extraction and denture service being indicated.

Mottled enamel was encountered in six men. These men were all from the same province and lived in the same lowland area.

Calculus was found in almost all the men. The condition varied from mild salivary calculus formations with very little stain, to more extensive serumal deposits, especially in the labial, buccal, and lingual areas. Heavy betel-nut stains were associated with many of these cases.

There was one wound case of particular interest. A 40-year-old Filipino officer's cook, third class, who had joined the defending forces on Bataan, was hit by a shell fragment, coming from under the chin and outward with such direction and force as to fracture the mandible on the right side in two places and to cause extensive destruction of bone and soft tissue. The outer fracture was sawtooth in type, beginning at the symphysis and extending downward and posteriorly. The second was also of a jagged nature, extending from just anterior to the first molar downward and anteriorly. There was destruction of one-third to one-half the inferior border of the displaced segment.

SUMMARY OF DENTAL EXAMINATION

Total teeth examined.....	16,226
Number of patients.....	650
White	12
Filipino	616
Chinese	21
Chamorro	1
Spent time as:	
Prisoner of war.....	316
With guerillas and in the hills	334
Age range	from 19 to 62
Average age	29.5
Average teeth per patient.....	25
Total number of fillings present.....	1,361
Total fillings needing replacement.....	355
Type of filling material:	
1. Gold	800
2. Alloy	497
3. Porcelain	64
	} 75 percent good
Average number of fillings per patient.....	2
Total number of cavities.....	1,071
Total number of necessary extractions.....	521
Number of full upper and lower dentures.....	13
1. Acrylic	9
2. Rubber	4
	} good condition
Number of partial dentures.....	3
Type: a. Lingual bar, acrylic.	
b. Palatal bars, acrylic.	
Number of patients needing prosthetic work.....	102
	No. of
Pathologic conditions found:	cases
Sprue	1
Leukoplakia	1
Acute Vincent's stomatitis.....	38
Acute gingivitis	53
Beriberi	2
Pyorrhea	68
Calculus and stains.....	631
Betel-nut stains	24
Closed bite (extreme).....	4
Mottled enamel	6
Number of patients meeting present dental standards for enlistment in the United States Navy, 538 or 82 percent.	

The gross wound was treated by first aid on the spot, and approximately 36 hours later the patient was admitted to the Army hospital on Corregidor, where debridement was done under mandibular block anesthesia. The remaining section of the laterally displaced fragment was manipulated into position, and fixation anteroposteriorly was obtained by horizontal wire through the body of the anterior and posterior undamaged sections. The occlusion of the remaining teeth was adjusted and stabilized by

means of intermaxillary wiring. The skin wound was approximated at this time and sutured.

After 8 weeks the wires were removed and within a few weeks all of the remaining lower teeth were extracted. This was necessary because of advanced pyorrhetic conditions as evidenced in the upper arch.

Intra-orally the ridge is most adequate for denture service with but little lateral displacement of the fractured segment. Extra-orally the facial conformation is asymmetrical because of the extensive loss of bone and soft tissue. The soft tissue has healed into the "halfmoon" shaped area of bone loss. It would be interesting to observe the results of plastic surgery and prosthetic service on this patient.

SUMMARY AND CONCLUSIONS

1. Six hundred fifty liberated Naval personnel were examined to determine their fitness for active duty. Three hundred sixteen had been Japanese prisoners of war. An attempt was made to discover the effect upon their general medical, dental, and nutritional status since the onset of the war.

2. Thirty percent of the group were temporarily or permanently disqualified from active duty. It is our opinion that the numerous hardships suffered as prisoners of war were largely the factors causing rejection. An estimate is made that one-third of this number will eventually be fit for active duty. Only eight men, or 4 percent, were lost because of injury.

3. Laboratory facilities were not available. It is likely that such examinations would reveal additional disqualifications, particularly because the incidence of pulmonary tuberculosis was not so great as expected.

4. In the Philippines the diet of the masses is shown to be inadequate. The rations given the prisoners by the Japanese caused many to develop various degrees of deficiency disease.

5. The rate of helminth infection among the prisoners does not depart widely from that of natives examined for employment by local Naval activities, although a higher rate might have been expected because of crowding and bad sanitary conditions at the internment camp.

6. In evaluating the oral findings, it must be borne in mind that the dental facilities in this area for all military personnel as well as civilian population were very meager. Local supplies and equipment were confiscated early in the occupation, leaving to the few available dentists only the alternative of temporary treatment, or of extraction when pain was acute.

7. Among the most significant findings was the remarkable recovery of this group from the many physical manifestations of malnutrition with so few serious dental conditions, and this despite the lack of professional care and the complete absence of facilities and armamentarium for adequate home care.

8. It is the opinion of the authors that a more exhaustive survey of this group of islands would show that the native Filipino is endowed with excellent oral development, and with good tooth structure, size, shape and arrangement, with the best dentition possibly being found in the highland provinces where the dietary conditions more closely approximate those of the better farming areas in the midwest and northern United States.

ACKNOWLEDGMENT.—The authors extend their appreciation to M. D. Fuentes, Chief Pharmacist's Mate, U.S.N. His familiarity with the language and with the nature of the prison camp, being himself one of the prisoner group, made the task of gaining valuable information much easier and more accurate.



ASYMPTOMATIC INTESTINAL MYIASIS

Two Army privates from the same company reported to the sickbay complaining of worms in their stools which they had noticed the previous day. There was no symptomatic relationship to the gastro-intestinal system, such as abdominal pains, distention, diarrhea, constipation, nausea or vomiting. Appetite was good, bowel movements regular, and sleep was sound. They had been overseas 18 months and 26 months, during which time neither had been sick.

Freshly voided feces examined immediately revealed numerous fly larvae in various samples of the stool. There were no larvae grossly present around the anus. Microscopic examination revealed the larvae to be of the common housefly, *Musca domestica*. Treatment consisted of purgation with magnesium sulfate. At no subsequent time were larvae found. The men had been eating regular Army chow and had not eaten any native food. Usually the men used heads that were screened and burned out daily. On several occasions while on working parties the regular camp heads were not available. The possibility of larvae being deposited around the skin of the anus and crawling into the rectum cannot be ruled out.—OKULICZ, S. J., Lieutenant (MC) U.S.N., and PHILLIPS, T. T., Pharmacist's Mate, first class, U.S.N.R.

BACTERIAL CONTENT OF OPERATING-ROOM AIR ABOARD SHIP

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The chance location of a ventilating duct opening directly over the center of the operating table became the occasion for this study of the bacterial content of the operating-room air aboard ship.

The operating room itself is located on the starboard side, outboard, between frames 42 and 48 on the main deck of a converted Liberty ship. The single port is kept tightly closed, and as a result the sole source of air is via the ventilating system. Originally, following the initial conversion, this system consisted of a series of metal ducts, through which air was blown by a fan operated by a 4-horsepower Wagner motor. The conventional anemostats covered the air vents in the operating room, one of which, as stated, was located directly over the operating table; the other was 5 feet away but so installed that the air currents were directed toward the table.

It was apparent that any open wound of the patient on the table would be in the direct line of air blast from the ventilating system.

Accordingly a major remodeling job was undertaken at a Navy yard. Both anemostats were removed and airtight metal plates applied to their openings. The ducts were changed; in the case of the one over the table, to extend beyond it; in the one adjacent to the table, to curve away from it. The extension ducts were smaller, rectangular, and covered with $\frac{1}{2}$ -inch wire mesh screen.

Following this remodeling, the original fault was corrected. However inspection of the intake air vent of the ventilating system, which was located 10 inches from the level of the boat deck directly over the operating room, revealed that it was covered with $\frac{1}{2}$ -inch mesh screen. With the system in operation a power-

ful suction was developed. At the other end of the system a powerful air blast was delivered. Whether this system picked up and delivered considerable dust was the next question to be answered.

Sterile Petri dishes containing autoclaved nutrient agar as a culture medium were opened for varying periods of time in the direct line of the current of air from the vents. The plates were incubated for 24 hours at 37° C., with these results:

Control plate		No growth		
30-second exposure plate		5 colonies (Staph. albus)		
1-minute	do	14	do	do
3-minute	do	21	do	do

Staphylococcus albus was identified from the appearance of the large, smooth, raised, moist, white colonies on the nutrient agar, by stained smear, and by subculturing on lactose- and glucose-agar slants.

The average temperature in the operating room at the time was 84° Fahrenheit.

To determine an effective filter for the dust influx and its potential contamination of any open wound, exposures were made utilizing different materials.

The air vents were covered with a double thickness of heavy surgical lint. This was so effective a filter as to amount almost to complete closure. The results of the culture made as before are as follows:

Control plate		No growth		
30-second exposure plate		1 colony (Staph. albus)		
1-minute	do	1	do	do
3-minute	do	2 colonies		do

The average temperature of the operating room was 102° Fahrenheit. The fact that this heavy filter cut down the available air and thus permitted the room temperature to rise to uncomfortable, unworkable heights, especially while the ship was anchored in the waters of the South Pacific, made its use impracticable, even though it effectively cut down the dust and the air-borne bacteria.

Another series of cultures was taken using a single layer of surgical lint with the following results:

Control plate		No growth		
30-second exposure plate		No growth		
1-minute	do	2 colonies (Staph. albus)		
3-minute	do	2	do	do

The operating-room temperature was 92° Fahrenheit. Although the contamination had been materially reduced, we continued to

swelter as we worked. Hence a more practical filter was sought.

A culture series was then taken, using two layers of surgical absorbent gauze, Type VII, 20 by 12, Stock No. 2-425, with the following results:

Control plate		No growth
30-second exposure plate		No growth
1-minute	do	No growth
3-minute	do	2 colonies (Staph. albus)

The average operating-room temperature was 82° Fahrenheit.

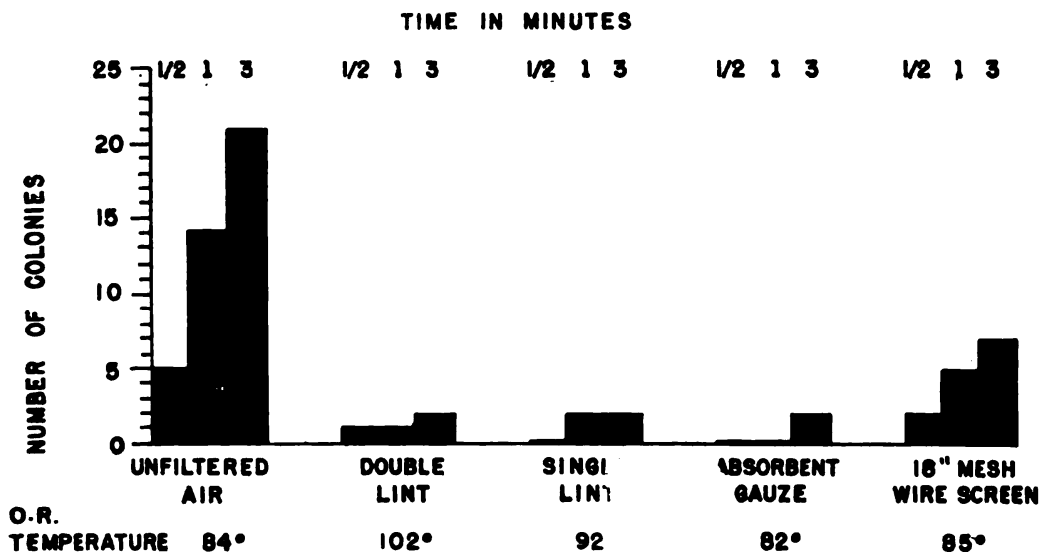
This result was pleasing, inasmuch as the effectiveness of gauze as a filter was in doubt because of its apparently large mesh. Upon seeing the result of the cultures, however, it was conjectured that the lint attached to the gauze meshes made it an efficient filter. This was amply proved when the gauze was removed at the end of 1 week. The inside of the filter area was black with accumulated dust particles. The necessity of changing this filter at weekly intervals was also obvious.

As a last attempt to find a filter which would not cut down the air supply unduly, exposures were taken using one layer of fine copper screen, Standard Navy Stock 42-c-20455, mesh 18 per inch, as filter. Following are the results:

Control plate		No growth
30-second exposure plates		2 colonies (Staph. albus)
1-minute	do	5 do do
3-minute	do	7 do do

The average operating-room temperature was 85° Fahrenheit,

Even though this screen was of an extremely fine mesh, it did not have any lint to facilitate its action as a filter, and conse-



quently permitted more dust to go through. The relative temperature was satisfactory with its use, but it was considered inferior as a filter to two layers of gauze.

The accompanying chart is a compilation of the data obtained.

The solution to the problem, in the absence of air conditioning, was the utilization of two layers of gauze as a filter. When changed weekly this offered the best protection from dust and the most comfortable operating-room temperature.

SUMMARY

1. Bacterial cultures of air delivered to a shipboard operating room via a standard ventilating system were studied.

2. The effectiveness of different types of air filters in bacterial restriction was checked.

3. A double thickness of ordinary absorbent gauze kept out most of the bacteria, as shown by bacterial colony count, and provided the maximum ventilation as indicated by room temperature readings. The wisdom of utilizing a filter of this type is apparent when the colony counts of the unfiltered air are compared with those of the filtered.



SULFAGEL IN BURN THERAPY

Sixty-four preparations have been examined employing gelatin and the sulfonamide drugs in an attempt to develop a dressing for burns which would embody the advantages of this type of film. It is recognized that there is considerable opposition to the local use of the sulfonamides. However, there is to be considered the advantage of obtaining high, local concentrations of sulfonamide drugs by means of local application without elevating the total blood stream concentration by absorption to dangerous levels. "Sulfafilm" had previously shown more rapid healing time for burns than had other types of therapy; however, based on limited clinical experience, it appears that "Sulfagel" gives earlier and better granulation than "Sulfafilm" in burn therapy. This, primarily, is due to the difference between a substance which is essentially a foreign body contrasted to a substance, which is, after a fashion, similar to animal tissue in its composition. Furthermore, "Sulfagel," when applied to body surfaces, presents a transparent dressing which possesses certain advantages.—FLACK, H. L.; CLARKE, D. A.; and TICE, L. F.: Preliminary report of new gelatin product. *J. Am. Pharm. A.* 34: 187-190, July 1945.

A RAPID METHOD FOR THE PRIMARY ISOLATION AND IDENTIFICATION OF NEISSERIA

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There is great variability in the ability to isolate and identify the various species in the genus neisseria. Some of the species (*Neisseria catarrhalis*, *N. sicca*, *N. flava*) grow easily on simple media, whereas other species (*N. gonorrhoeae*, *N. intracellularis*) are delicate and difficult to cultivate.

Various special media have been employed to isolate the meningococcus and gonococcus. Of these media, those described by Peizer and Steffen¹ and by Weckstein² have been found most effective in the isolation and culture of these organisms. All the species of neisseria will grow on these two special media. Routinely after presumptive identification and isolation of pure cultures of the various neisseria, positive confirmatory identification is made on sugar fermentation media. Subculturing is often a time-consuming task and it is frequently difficult to carry pure strains until positive identification is made.

By incorporating the advantages of these media, modifying them so that isolation, identification, and sugar fermentation confirmation could be made on one or two plates of solid media, subculturing to obtain pure cultures of the neisseria is made unnecessary. Special media for sugar fermentation confirmations, moreover, become superfluous. In this way much time is saved in the positive identification of the organism.

This paper is limited to the confirmatory identification of *Neisseria gonorrhoeae*, *N. intracellularis*, and *N. catarrhalis*. However recommendations are made for the isolation and identification of all species.

Preparation of the medium.—In order to prepare the marked glassware and routine solutions the following steps are taken:

¹ PEIZER, L. R., and STEFFEN, G. I.: Modification of horse plasma hemoglobin agar for primary culture of gonococcus. Usefulness of Nile blue A in this medium. Ven. Dis. Inform. 23: 224-226, June 1942.

² WECKSTEIN, A. M.: Isolation of *Neisseria diplococci* and hemolytic streptococci. Hosp. Corps Quart. 17: 77-78, July 1944.

1. A 500-cc. Erlenmeyer flask is marked at 320 cubic centimeters. If permanency is desired, flasks may be etched with a diamond-point pencil. This flask is designated as the agar base flask.

2. A second 500-cc. Erlenmeyer flask is marked at 130 and 320 cubic centimeters. This flask is then plugged with a cotton stopper which is further protected by a paper covering. The flask is autoclaved for at least one-half hour at 15-pounds pressure. This flask is designated as the enrichment medium flask.

3. Forty cubic centimeters of a 15-percent solution of disodium phosphate is autoclaved for 20 minutes at 15-pounds pressure.

4. One hundred cubic centimeters of a 0.04-percent solution of Nile blue A is similarly treated for 20 minutes at 15-pounds pressure. This solution may be used as long as the supply lasts.

5. Finally 250 cc. of distilled water is autoclaved for 20 minutes at 15-pounds pressure.

For the preparation of the agar base and the enrichment medium the following is done.

1. A mixture of Bacto proteose peptone No. 3, sodium chloride, Bacto agar, Bacto maltose (or dextrose for dextrose plates) and distilled water are employed and mixed in the following quantities in the agar base flask:

- a. 5 gm. Bacto proteose peptone No. 3.
- b. 5 gm. Bacto agar.
- c. 3.2 gm. Bacto maltose (or 3.2 gm. dextrose for dextrose plates).
- d. 1.5 gm. sodium chloride.
- e. 0.01 gm. neutral red.
- f. 250 cc. distilled water.

The mixture is then thoroughly stirred, care being taken to see that the indicator is completely in solution. The flask is plugged with a cotton stopper and autoclaved for 20 minutes at 15-pounds pressure, after which it is cooled to 60° centigrade. This mixture must not be re-autoclaved.

The preparation of the enrichment medium must be performed under aseptic conditions and the final mixture tested for sterility. The enrichment mixture may be stored at refrigerator temperature for at least one month. It consists of a stock mixture of plasma, hemoglobin, and disodium phosphate prepared in advance. The materials are mixed in the following manner in the enrichment medium flask:

1. Sterile decanted human plasma is first added to the 130-cc. mark.
2. Five-percent human hemoglobin solution is added to the 320-cc. mark. The hemoglobin solution is prepared by adding 12.5 cc. of sterile sedimented human red blood cells to the 250 cc. of sterile distilled water. The solution may be kept for at least 1 month at refrigerated temperature.
3. The 40 cc. of the 15-percent sterile solution of disodium phosphate is now added.

The pouring of the agar plates employs the following steps:

1. The enrichment medium (70 cc.) is added to the 320-cc. mark of the agar base flask which has been cooled to 60° centigrade.
2. Then 1.92 cc. of the 0.04-percent solution of Nile blue A is added to the

mixture of the agar base and enrichment medium. From 20 to 22 plates may be poured from this amount of hemolyzed human blood plasma agar.

3. The plates are stored at refrigerator or room temperature.

Certain general points should be considered when preparing the medium. The pH of the agar base will fall within about 6.9 to 7, and before use it must be adjusted to a pH 7.3 or 7.4 by the addition of disodium phosphate. This is the optimum pH for neisseria. The useful pH range of neutral red is from 6.8 to 8 and the color change is from yellow in an alkaline medium to red in an acid medium. The addition of the Nile blue A produces a light yellow-green plate. Nile blue A does not inhibit the growth of neisseria but helps considerably in cutting down contaminants; it suppresses the growth of many common strains of staphylococci, coli, and diphtheroids.

The enrichment medium should be kept at room temperature for from one-half to three-quarters of an hour before being added to the cooled agar. If the agar is hotter than 60° C., insoluble phosphates will be formed upon the addition of the enrichment mixture. The inoculated (streaked) plates are incubated at from 36° to 37° C. under partial CO₂ tension in a candle jar. This will produce a tension of from 8- to 10-percent CO₂, in which the plates are incubated for from 24 to 40 hours.

Only human, rabbit, or guinea pig blood and plasma may be used in the enrichment medium. With horse, beef, or sheep serum the gonococcus always produces acid in glucose and maltose agar.³ The author, moreover, has found that this medium may be effectively used without the addition of para-aminobenzoic acid. The fact that the patient has taken sulfonamides does not inhibit growth in this medium.

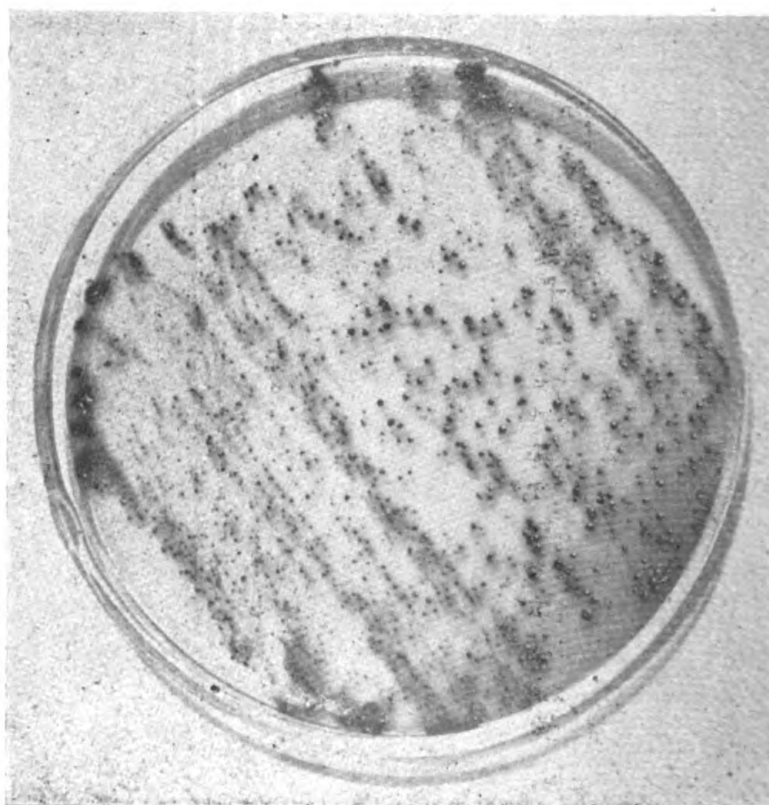
The medium is streaked in routine fashion or by the use of special applicators, the streaking methods depending upon the source of the specimen. In taking gonococcus cultures, a swab is fashioned from an applicator with one end tapered and bound with a small amount of tightly adherent absorbent cotton. The use of this type of swab is of paramount importance in taking cultures in a male patient. The penis should be thoroughly cleaned with tincture of green soap, followed by 70-percent alcohol. No soap or alcohol should be left on the penis before the culture material is taken. Prostatic and urethral cultures are taken by inserting the sterile swab for a distance of 2 cm. into the urethra and rotating it to collect the expressed fluid. In streaking the plate, the swab is carefully rotated so that all parts of its

³ PRIZER, L. R.: Identification of gonococcus from cultures and effect of certain animal sera on fermentations of gonococcus. *J. Bact.* 43: 733-738, June 1942.

surface come in contact with the culture medium.

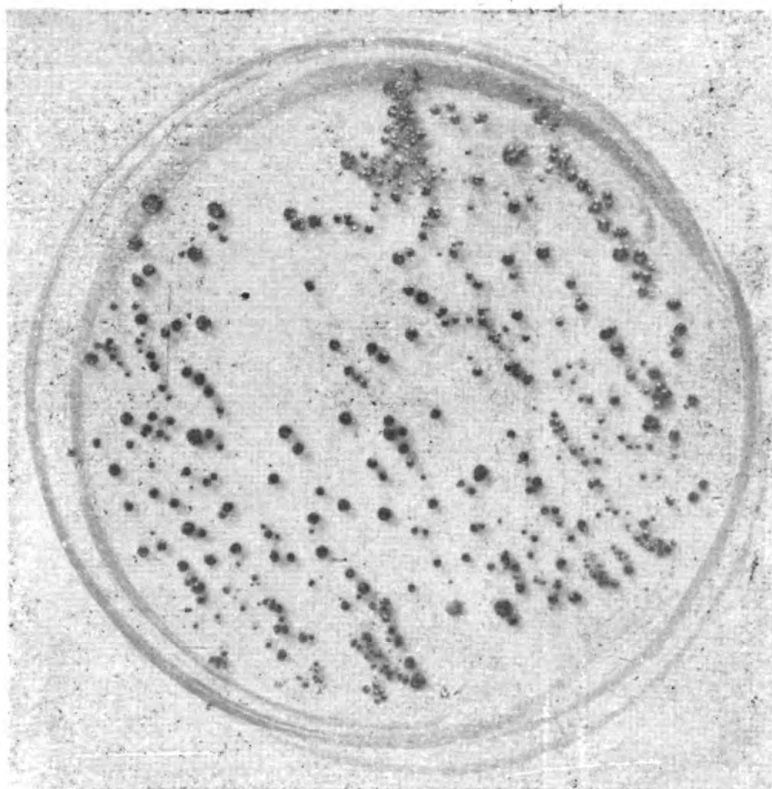
COMMENT

In view of the fact that the gonococcus will ferment dextrose but not maltose, the meningococcus both dextrose and maltose, and *N. catarrhalis* neither of these media, two plates, one containing dextrose and the other maltose, should be streaked with the specimen. Fermenting colonies are pink or lavender and are easily observed against the yellow-green background. Nonfermenting neisseria colonies are transparent or whitish and have a green tint.



1. Typical plates of the gonococcus growing on hemolyzed human blood plasma agar containing Nile blue A and 1-percent maltose. Colonies show typical oxydase reaction.

Neisseria organisms produce characteristic irregular, raised, mucoid colonies (figs. 1 and 2). The plates are examined macroscopically for those morphologic characteristics and for evidence of fermentation (pink or lavender colonies). The presence of gram-negative diplococci on plates which do not show fermentation is identified and verified by Gram staining of a typical colony after



2. Old colonies of same organisms as seen in figure 1.

the addition of a drop of oxydase dye (p-aminodimethylaniline monohydrochloride) to the suspected colony. If gram-negative diplococci are present, the colonies will turn pink, then purple, and finally assume a black coloration. The author first tests a single colony and if he finds it negative covers the plate with a thin covering of oxydase dye, thus locating any colonies which might have been missed. Oxydase is prepared as a 1-percent solution in distilled water. It is best prepared fresh before use.

Neisseriae which ferment 1-percent carbohydrates producing typical lavender colonies after 40-hour incubation, may not give a positive oxydase test. Confirmation of fermenting colonies is made by the demonstration of typical gram-negative diplococci on smear. Fermenting neisseria colonies will be pink in color after 24 hours of incubation and may show variability in oxydase reaction. It appears that the enzyme oxydase is inactivated at an acid pH. This is apparently the reason why some strains of the gonococcus have been reported as oxydase negative when grown on a 1-percent carbohydrate medium which these strains are capable of fermenting.

If the colonies on both plates demonstrate typical gram-negative diplococci on gram-staining, the organism is a gonococcus if it

ferments the dextrose plate only; it is a meningococcus if it ferments both maltose and dextrose plates, and it is catarrhalis if it ferments neither of these sugars.

If the suspected material is demonstrated to be meningococcus, verification may be made by a slide agglutination test with polyvalent antimeningococcic serum. Identification of specific meningococcic type is also possible directly from the plate by testing isolated colonies. Identification of other neisseriae can be made by using plates containing levulose, sucrose, lactose, or galactose as the fermenting sugar.

In routine work with the gonococcus, maltose need be the only carbohydrate medium employed. In view of the fact that all of the gram-negative diplococci, with the exception of the gonococcus and *N. catarrhalis*, ferment maltose, nonfermenting colonies typical of neisseria in Gram stain and oxydase reaction may be assumed to be either the gonococcus or *N. catarrhalis*. The source of the material may be sufficient to render positive identification at this point. However if definite confirmation is deemed advisable, another plate or simple agar medium may be streaked with the suspected colony and incubated at room temperature. *Neisseria catarrhalis* will grow at room temperature and on simple media which the gonococcus will not do.

SUMMARY

A medium is described for the cultivation and identification of *Neisseria gonorrhoeae*, *N. intracellularis*, and *N. catarrhalis* so that isolation, identification and sugar fermentation confirmations can be made on one or two plates of solid media. Subculturing to obtain pure cultures becomes unnecessary. Special media for sugar fermentation confirmations are not needed. The use of this medium will save a great deal of time in the positive identification of these organisms.

By pouring plates containing various sugars in this medium, identification of all species of neisseriae is possible.

A NEUROPSYCHIATRIC QUESTIONNAIRE FOR GROUP EXAMINING

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and

JOEL M. HILL

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The questionnaire presented here was developed to meet the needs of a large neuropsychiatric service in a Naval hospital. Designed as an aid in psychiatric examining, it has proved useful both as a time-saver and as an instrument of investigation.

Essentially the questionnaire is a group method of conducting a preliminary psychiatric interview and obtaining the psychiatric history. Group methods are relatively new in psychiatry, except in the field of psychotherapy, and may eventually have considerable usefulness.

One basis for this expectation is the steady development of personality tests and adjustment inventories. Although intended primarily for use with "normals," the widespread use of these psychometric devices by business and industry has demonstrated the utility of group methods for eliciting significant personnel information. More recently psychologic tests for aviation cadets have shown that pertinent and reliable biographic data can be obtained by means of a questionnaire.

Each person is, of course, an individual problem. Clearly it is absurd to think that any group psychometric device can supplant the personal interview. Such devices may, however, supplement the interview to a valuable degree and allow a more effective distribution of the examiner's time.

An adequate and comprehensive history is important for every neuropsychiatric patient, but no part of the psychiatric examination is more time consuming. A great many questions must be asked. Most of these questions are answered negatively, because in many respects the patient's personal and family background is not unusual. Discovering the unique and atypical elements in a patient's past life—the primary purpose of the history—requires a disproportionate amount of the examiner's time. It is the function of the questionnaire to do this questioning, and to uncover

the significant information without expenditure of time and energy on the part of the examiner.

At the time of the personal interview the patient's questionnaire can be reviewed in a minute or two. Details which are not clear may be investigated further. The remainder of the time ordinarily spent on the history is then available for investigating the immediate reaction-pattern of the patient, for discussing the problems which seem most important to him, and for psychotherapy.

Wording of the questions of the questionnaire is the result of considerable experiment. Experience has shown that in their present form they are easily comprehended and answered by the patient.

Scanning of the questionnaire has been facilitated for the examiner by casting the questions in a yes-no form. "Yes" indicates positive information. Most of the questions are answered negatively, indicating average or typical experience.

We have labeled the questionnaire, in the form given to patients, Interview Questionnaire.

INTERVIEW QUESTIONNAIRE

FROM: Your Ward Medical Officer.

Your Ward Medical Officer will have a personal interview with you as soon as possible. In the meantime you can help by giving in advance some of the information he will require. Consider these questions as though he were asking them personally, and keep them confidential. If there are any you would rather not answer, leave them blank. There will be time later to talk more about the things that seem most important to you.

NAME..... Rate..... Date.....
 (Last Name) (First Name) (Initial)

CC 1. What is your chief complaint or trouble at the present time?

2. What other complaints or difficulties do you have.....

PI 3. When did you first notice these symptoms?.....

4. When did they begin to get worse? Give details.....

5. When did you first go on the sick list for these complaints?.....

6. Where?

7. Tell all the hospitals or other medical activities where you were treated, and give the dates.....

PH 8. Where were you born?.....Date of birth.....

9. How many children including yourself were there in the family?

10. Where did you come in the family; were you first, second, third, or what?

11. When you were growing up did you live with someone besides your parents most of the time.....If so, with whom?.....

12. Were you sick a lot during childhood?.....What serious illness did you have, and at what age?.....

13. Were you inclined to be nervous or high-strung?.....
14. Did you feel you were punished more than the average child?
.....
15. Were you the favorite child in the family?.....Did others
consider you the black sheep of the family?.....
16. Did you stammer or stutter?.....If so, at what age did
you stop?
17. Did you talk in your sleep?.....If so, at what age did you
stop?
18. Did you walk in your sleep?.....If so, at what age did you
stop?.....
19. Did you wet the bed?.....If so, at what age did you stop?
.....
20. Did you bite your fingernails?.....If so, at what age did
you stop?
21. Were you afraid of the dark?.....Up to what age?.....
22. Did you often have bad dreams or nightmares?.....
23. Were you inclined to be overconscientious?.....
24. Did you feel lonely quite a bit of the time?.....
25. Did you have a hot temper?.....
26. Did you have the feeling nobody cared much about you?.....
27. Did you feel uncomfortable in crowds?.....
28. Did high places frighten you?.....
29. Name any special fears you had.....
30. What was the last grade you completed in school?.....
How old were you when you stopped?.....
31. How many grades did you fail?.....Which ones?.....
32. Did you find it hard to learn?.....
33. Were you fighting with the teachers much of the time?.....
34. What sort of work did you do after you left school? Tell the
different jobs you had and how long you held them.....
35. How many times were you fired?.....
36. Were you inclined to fight with the boss quite a bit?.....
37. If you have any form of recreation or sport or any hobby you are
especially interested in, list it here.....
38. Did you ever run away from home?.....If so, how old
were you?..... What was the reason?.....
39. Were you ever arrested, or in a juvenile court, or in a reform
school?.....If so, give the details of it.....
40. Have you "bummed" around the country?.....If so, tell
about it
41. Were you ever picked up for vagrancy?.....
42. How old were you when you became conscious of yourself sexually?
For example, how old were you when you first learned about mas-
turbation?.....and how old were you when you began
sexual activity with the opposite sex?.....
43. Are you married or single?.....If you are married
how old were you at the time?.....Were you ever married
before?..... Have you ever been separated or divorced?
.....If you have any children, how many?.....
How do you get along with your wife?.....
44. Have sexual problems worried you a good deal?.....Did
they worry you when you were younger?.....

45. What church did you go to when you were young?.....
46. How much religious interest do you have now; are you more interested or less interested than the average person?.....
47. Has there been any marked change in your religious attitudes at any time during your life?.....If so, tell about it.....
48. Have you ever been hit on the head and knocked out?.....If so, give dates and details.....
49. Have you ever had fainting spells?.....If so, give details.....
50. If you ever had a nervous breakdown, or if you were especially nervous at some period of your life, tell about it.....
51. When did you enlist?.....
52. When were you called to active duty?.....
53. What was your rate then?.....
54. What is your present rate?.....
55. List any military or naval service you had before this enlistment.....
56. If you have had foreign shore duty tell where it was and how long you were stationed at each place.....
57. If you have had sea duty what ships were you attached to?.....How long?.....
58. If you have been in combat, where was it?.....
59. How many air raids have you been through, if any?.....Where?
60. If you have had any Naval or military offenses, give details.....
- FH 61. If your father is living, state how old he is.....Is he in poor health?.....If so, what is his trouble?.....
62. If your father is not living, how old was he when he died?.....What did he die from?.....How old were you when he died?.....
63. If your mother is living, how old is she?.....Is she in poor health?.....If so, what does she suffer from?.....
64. If your mother is not living, how old was she when she died?.....How old were you when she died?.....
65. Were your parents ever divorced or separated?.....If so, how old were you at the time?.....
66. How well did your parents get along with each other?.....
67. Did any of your relatives (father, mother, brothers, sisters, aunts, uncles, cousins, grandparents) ever have a nervous breakdown?.....If so, give as much information as you can about it.....
68. Did any of your relatives have convulsions or fits?.....If so, give details.....
69. Have any of your relatives been in trouble with the law?.....If so, give details.....
70. Have any of your relatives committed suicide?.....If so, give details.
- ME 71. Do you feel sad and depressed quite often?.....Most of the time?
72. Are you often moody?.....Most of the time?.....
73. Do you feel irritable and bothered by little things?.....Most of the time?.....
74. Are there times when you feel panicky, without knowing quite why you feel that way?.....

75. Do you have a general feeling that something is about to happen to you?
76. Do you have any worries?.....If so, describe them.....
77. Describe how you feel.....
78. How do other people feel and act toward you?.....
79. What do you think ought to be done for you?.....
80. How soon do you feel you'll be able to return to duty?.....

VALIDITY AND RELIABILITY

The neuropsychiatric questionnaire described here has been given three tests for validity and reliability.

1. For 100 patients questionnaires filled out on admission were compared with duplicate questionnaires filled out from three to eight weeks later. In most cases an almost verbatim consistency was found. The exceptions were a few psychotics, for whom the second questionnaire mirrored the progress of the psychosis.

2. Questionnaires were compared with histories taken in routine manner by ward psychiatrists. Most of the positive information elicited by either method was found to have been elicited by both. On the average, however, one item of information uncovered by oral interview was missed by the questionnaire; and three items brought out by the questionnaire were overlooked in the interview.

3. Both questionnaires and interviews were compared with social service histories obtained in the course of hospital routine from outside sources. Using these histories as a criterion, questionnaires and interviews were compared in regard to the number of information items which were confirmed, the number refuted, and the number missed entirely. The two methods were found to be equally accurate, although the number of items missed by the questionnaire was smaller.

Information obtained by the questionnaire, then, is fully as accurate and noticeably more complete than that obtained by an oral interview as performed under normal working conditions on a crowded neuropsychiatric service. It can be seen that when the questionnaire is used, even a few minutes of supplemental oral questioning will enable the examiner to achieve results definitely superior to those ordinarily obtained in from 20 to 30 minutes of interviewing.

ADVANTAGES

Economy of time is the greatest single advantage of this group method of history-taking. As in the case of group psychotherapy, however, there are by-product values to be derived from the use of the questionnaire.

Morale.—One or two hundred patients brought in at one time means some men will have to wait a week or more for a complete interview. If these patients are given the questionnaire to fill out at once, morale is sustained for many days. The patients feel that thoughtful provision has been made for them, and that they have received immediate personal attention; consequently they are more content to wait their turn for an interview.

It is important to remember that most of the patients in a Naval hospital are young. From their school experience they are accustomed to group tests, direct questions with true-false or multiple-choice answers, and questionnaires. They lack the resistance of the older generation to putting down on paper information about themselves. As products of modern education they not only accept, but are favorably inclined toward, efficient group methods.

Rapport.—Preliminary rapport is established by the questionnaire. When the patient comes in for an interview he has already had an opportunity to talk about himself in writing, and consequently feels the examiner understands some things about him.

The intimate and personal way in which patients respond to the questionnaire is illustrated by the following quotations:

Question 13 (nervous?): "Yes, doctor, I have been nervous all my life, far back as I can remember."

Question 24 (lonely?): "Yes, that is just how I always felt."

Question 39 (reform school?): "I was in St. Anthony's Reform School for 6 years."

Question 43 (get along with wife?): "We fight quite a bit over my drinking, when I'm home."

Question 49 (fainting spells?): "In the past I've fainted on several occasions from what I thought was being overheated; fainted once in front of hundreds of people during a Christmas play—in which I was one of the saintly actors!—(Never did live it down)."

Question 67 (nervous trouble in family?): "One brother had insanity for about a year, but has been drafted into Army."

Question 69 (relatives in trouble?): "My uncle was in jail for shooting and cutting up a couple of men."

Question 73 (feel irritable?): "Yes, I do. O.K. with something definite (sic) to work forward to."

Question 74 (panicky?): "That's right, I sometimes think I'm going to die in a few minutes."

Question 80 (return to duty?): "You're the Doctor. Whenever you say so."

Time for the patient.—The questionnaire not only gives the ex-

aminer more time, it also gives the *patient* more time. He has an opportunity to go into detail about his problems. He is not hurried.

The number of patients to whom this factor of time is important is surprisingly large. Those who stutter, or find it hard to talk, particularly welcome the opportunity to fill out the questionnaire. Frequently patients will spend 2 or 3 days on it, working in intervals of a few minutes each. A typical comment is: "When I talk to the doctor I get confused and can't remember what I want to tell him. *This way* I can put it all down when I think about it."

Significant reactions.—Willingness to fill out the questionnaire provides an interesting sidelight on the patient. At one extreme are those patients who return the questionnaires, blank, within a few minutes. Disgust and scorn accompany it. "I won't fill out that damn thing. It's kid stuff." "It's a lot of —." Urging is futile for these men, but their reaction should be noted, because it is significant. We have found that these patients, almost without exception, turn out to be psychopaths. Occasionally paranoid personalities will respond in a similar manner.

At the opposite extreme are the combat and operational fatigues. Fatigue patients sit down and start working at once on the questionnaire. They may be shaky and able to work for only a few minutes at a time, but invariably they fill it out carefully and in detail. They take it for granted that it is for their own good or the doctor would not be asking them to do it.

An element of relief is also evident in these fatigue patients as they work. Speech is often an effort, yet they want to talk about themselves. The directed questioning of the questionnaire appears to give them a feeling of articulateness. Nor is it infrequent for these patients, after being stimulated into thinking more objectively about themselves, to reach the interview with an increased sense of perspective and insight.

Accessory information.—A number of impressions of diagnostic value come as a by-product of the questionnaire. Illiteracy, for example, is evident at once. The educational level of the patient can be estimated fairly closely by his use of words. Mental deficiency reveals itself by answers which demonstrate lack of comprehension of the question. The catatonic often blocks completely when faced with the specific task of the questionnaire, even though his ward behavior may have shown no gross tendency toward a stuporous reaction.

Those paranoids who are willing to fill out the questionnaire reveal their reaction-pattern in two ways. Some of them show the stiff perfectionist handwriting associated with the meticulous

paranoid. And some of them fill out the questionnaire with a solid set of negative answers. As in an oral interview, they portray themselves as too perfect.

Aphasia is quickly apparent. One aphasic stated his chief trouble as "can't talk," and wrote he was ready for duty. "As soon as am better to talk and at home I will glad back to the submarine."

Schizoid reactions and early dementia praecox manifest themselves by unusual or bizarre responses. One patient, for example, in describing how he felt, wrote: "Anger and Judgment rule my thoughts." Another patient stated he would be able to return to duty "when I learn Life."

Special uses.—Neuropsychiatric consultations on medical or surgical patients are expedited with the questionnaire. When the neuropsychiatric staff is particularly burdened, the referring officer can help materially by having the questionnaire filled out by the patient in advance of the consultation.

The instructional value of the questionnaire should also be mentioned. Interns at this hospital, familiarizing themselves with psychiatric procedures, have discovered the questionnaire is a useful guide in interviewing patients.



CELLULITIS OF LOWER EXTREMITY ABOARD DESTROYER ESCORTS

Cellulitis of the lower leg and ankle is a common serious infection aboard destroyer escorts. The ankle seems particularly liable. The number of sick days, however, has been minimized by early recognition of the condition. The endemic nature of the cellulitic processes caused concern in that no definite etiologic factor was apparent. Upon closer scrutiny of the affected extremities of each patient, it was found that sub-clinical epidermophytosis of the toes and interdigital areas was present in about 50 percent of the cases. Several patients had a blister in various stages of healing on the heel, resulting from shoe trauma. Walking is greatly limited on a ship at sea, especially the smaller types, and a ship's personnel walks a great deal on shore liberty, eager to see as much of the beach as possible in the limited time available. Consequently the irritation and trauma of walking on tender feet results in the tearing down of normal barriers to infection. It is after this period on the beach that cellulitis of lower extremities occurs.—KUBER, M. E., Lieutenant (MC) U.S.N.

THE NUTRITIVE VALUE OF NAVAL FOOD

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For two centuries the close relationship between the health of men and their diet has been clearly recognized. Lind, the father of Naval hygiene, in 1757 was one of the earliest to recognize the importance of the diet. Lind's books can still be read with profit by modern specialists in nutrition. One of the best reviews covering the history of the Naval diet since the time of Lind is that of Brooke (1).

During the first World War excellent studies of Army messes were made by Murlin and Hildebrandt (2). Samples of meals were collected in many camps. These were analyzed for protein, fat, carbohydrate, and ash content. At that time quantitative methods for the determination of vitamins were too difficult to permit extensive use.

In the interim since the above studies, rapid methods have been developed for measuring the vitamins in food. These have not been employed extensively, however, to evaluate the nutrients in meals served in Army or Navy messes. The general trend has been to estimate the nutritive value of food consumed by the use of factors applied to the food supplies issued.

Calculated values for foods consumed are subject to many errors because of the uncertainty of the values applied as corrections for losses due to wastage and destruction of nutrients during cooking. For this reason facilities were developed in 1943 at the Naval Medical Research Institute to permit direct determinations of nutrients consumed by men in Naval messes.

As correct sampling is essential in evaluating food consumed, much attention has been devoted to the taking of representative

samples of the meals. The pans of food were weighed after they were filled and just as they were taken from the steam tables. Empty pans were weighed as they were taken from the tables. During serving, the number of helpings from each pan was recorded by the use of multicounters. Thus the average weight of each serving was determined. From the number of men passing the cafeteria line, the mean value for food consumed as well as the mean helping can thus be estimated.

After food samples were taken they were converted into a slurry by means of the Waring Blendor, then frozen and held at a low temperature until analyzed. These methods of sampling are useful in any study involving the feeding of large numbers. The only one of the common vitamins that cannot be evaluated by these methods is ascorbic acid. Because of the rapid destruction of this vitamin in the presence of metal catalysts and enzymes found in uncooked foods such as salads, ascorbic acid must be measured in special samples of individual foods known to contain this vitamin.

In the studies made thus far, samples have been taken in a given mess for 21 consecutive meals. In a few instances samples have been taken for a second period of 1 week in the same mess.

In the earlier studies, analyses were run upon samples for each day as well as upon composites for a week, and excellent agreement was obtained between them. These earlier studies have been reported elsewhere (3) (4). The present report includes a recent study of a mess for recruits at the U. S. Naval Training Center, Sampson, N. Y., and a mess for nurses at Bethesda, Maryland. The former would be rated as a high quality mess for enlisted

TABLE 1.—*Nutrients consumed in typical messes for recruits and nurses*

	Recruits (Sampson)			Nurses (Bethesda)			Recommended dietary allowances (National Research Council)	
	Served	Plate waste	Ingested	Served	Plate waste	Ingested	Men (moder- ately active)	Women (seden- tary)
Total solids... (gm.)	590	25	565	485	77	408	.....	.....
Ash..... (gm.)	25	2	23	20	3	17	.....	.....
Protein..... (gm.)	109	5	104	91	17	74	70	60
Fat..... (gm.)	100	10	90	117	21	96	.....	.....
Carbohydrate..... (gm.)	355	8	347	257	36	221	.....	.....
Calories.....	2,760	140	2,620	2,445	401	2,044	3,000	2,100
Calcium..... (gm.)	2.06	0.05	1.99	1.15	0.18	0.97	0.8	0.8
Phosphorus..... (gm.)	1.88	0.06	1.82	1.40	0.24	1.16	.....	.....
Thiamine..... (mg.)	1.8	0.05	1.75	1.3	0.2	1.1	1.8	1.2
Riboflavin..... (mg.)	3.8	0.11	3.69	2.8	0.4	2.4	2.7	1.8
Niacin..... (mg.)	19	1.2	17.8	19	4	15	18	12
Ascorbic acid..... (mg.)	90	.....	.....	68	.....	.....	75	70

recruits, while the latter was an excellent mess for nurses.

A summary of the average nutritive value of foods served each day in these messes (table 1) indicates that the typical recruit consumes in the messhall food to provide about 2,620 calories, and the average nurse eats enough food to furnish 2,044 calories.

Wastage of food at Sampson was kept very low by stationing guards at the scullery and forcing men to consume food taken on their trays. In stations that do not follow this practice, plate wastage amounts to several times the values shown here. Such wastage may amount to 20 percent of the food.

The consumption of food at Ship's Service at Sampson was relatively high. This was sufficient to provide each man with 590 calories per day. Thus each recruit ingested enough food to furnish a total of 3,210 calories. At this level the typical recruit tends to gain in body weight.

The question of dietary allowances has been a matter for debate since the advent of modern nutrition about a hundred years ago. The question attracted much public interest in England during the nineteenth century when Chadwick discovered that prisoners fed moderate amounts of food lived longer than those fed very well or very poorly (5).

During the war the National Research Council attempted to establish allowances based on recognized essential nutrients (table 1). These allowances have been criticised as being too high to be practical. The material included in table 1, as well as that accumulated in our series of surveys, indicates that these levels of nutrients are readily attainable in messes of average quality in the Navy.

Most textbooks of Naval hygiene contain a section upon nutrition, listing the allowances per man for different food items carried by the ship. Various attempts have been made to estimate the nutrients ingested, from the food that disappears or is issued from stores during a given period.

Such estimates of calories are not reliable within about 20 percent (table 2). The chief reason for this lack of reliability is the difficulty in allowing suitable corrections for wastage. Thus if the pork or beef used contains much fat, the estimate of calories consumed becomes much too high. This is also true of the values for the amount of fat eaten.

Estimated values for calcium ingested are usually much too low. Estimates for water-soluble vitamins are moderately accurate except for ascorbic acid. This is subject to much variation as the result of the way foods are cooked. No one knows whether values estimated for vitamin A are accurate or not. In the case of this

TABLE 2.—*Comparison of the nutritive value of the food served per man per day, calculated from the total amount issued and the analytic values*

Nutrients	Galley B (4,470 rations)			Galley C (4,895 rations)		
	Long* method	Short** method	Analytic	Short method	Analytic	
					1st week	2d week
Protein.....(gm.)	102	111	107	140	98	109
Fat.....(gm.)	190	165	112	179	98	100
Carbohydrate.....(gm.)	337	347	336	418	321	355
Calories.....	3,465	3,323	2,780	3,849	2,555	2,700
Calcium.....(gm.)	1.0	1.0	1.3	1.4	2.0	2.1
Phosphorus.....(gm.)	.....	1.8	2.1	2.3	1.6	1.9
Iron.....(mg.)	.....	0.02	.....	0.03	.....	.....
Vitamin A.....(I.U.)	.....	10,380	.....	10,430	.....	.....
Thiamine.....(mg.)	2.4	2.7	1.9	3.4	1.5	1.8
Riboflavin.....(mg.)	2.8	2.6	3.3	3.3	3.3	3.8
Niacin.....(mg.)	26.5	26.5	17.7	32.5	18.0	19.0
Ascorbic acid.....(mg.)	.....	115	.....	135	82	90

* Long method: National Research Council Tables on Food Composition.

** Short method: Berryman-Chatfield Tables.

vitamin, estimated values are also subject to doubt since other factors in the diet may modify the absorption of vitamin A and carotene from the intestinal tract.

The data of table 2 afford comparisons between estimated values and actual ones based upon analyses of food served. The discrepancy between "estimated" values and real ones for food actually entering the stomach is really greater than indicated in this table because no corrections have been inserted for plate wastes. Numerous analyses are now available for single items of food and it may ultimately be possible to determine corrections that will improve estimations.

Because of the unreliability of estimated values, no valid comparison can be made between the nutrients consumed by Naval men in past eras and those ingested by modern sailors. Likewise comparisons cannot be made today of food consumed by men in the Army and Navy. Numerous estimates have been made for men in the Army, but actual data, based upon analyses, are unavailable.

Little is actually known about the nutritive value of food consumed by men aboard ship today. During a period of 40 days, observations were made recently aboard a modern carrier. The total food consumed was somewhat less than that eaten during recruit training. The average man ate food to provide about 3,000 calories.

The nutrients provided were comparable to those shown in table 1 as near as could be determined from critical observations by one used to judging such values.

The trend in Naval diets is undoubtedly toward meals with lower calories. The feeding of a large group of women in the WAVES has led to a refusal to consume high-calorie diets, with beans for breakfast and potatoes two or three times a day. The messing system may ultimately be changed to one of moderate lunches at noon with the principal meal in the evening.

As a rule menus seem too complex. This leads to a frequent repetition of such items as carrots and peas. Simplification of menus can be achieved without sacrificing nutritive value and with improvement in cookery.

For beverages many shore stations are now using several times the ration allowance of milk. Undoubtedly this wholesome trend toward a greater use of milk will increase as better forms of milk for reconstitution aboard ship become available. The nutritive value of the ration regularly improves as beverages containing milk are substituted for coffee.

The forgotten beverage frequently is water. Considerable efforts are often made to provide milk, coffee, and lemonade with meals, but the person who prefers water may have to get it by fighting his way through a crowded mess compartment to a scuttlebutt in the corner. In other stations excellent supplies of water are available near the chow line.

The excessive use of acid beverages is subject to some question. During a period of 3 weeks, one officers' mess, feeding over 300 men in the tropics, used enough synthetic lemonade powder so that each man ingested 4 gm. of citric acid daily. Each 8-ounce glass of this beverage was designed to provide 30 mg. of ascorbic acid and 1.4 gm. of citric acid. Under normal conditions this extra ascorbic acid is not needed, as it is provided in the citrus juices, tomato juice, and vegetables of the diet. The use of large amounts of citric acid beverage is subject to question because of the possibility of this acid attacking the enamel of the teeth. As this beverage is consumed it may have a pH value of 2 to 2.6. Recent data indicate that beverages at this acidity readily attack the teeth of dogs and rats (6). The effects upon human teeth remain unknown.

The cola beverages which are consumed in large amounts are also worthy of consideration because they have an acidity of pH 2.6. These beverages as consumed consist of a solution of phosphoric acid in 10-percent sugar solution. The acidity is usually masked by the sugar but becomes apparent if the solution is held in the mouth for a half minute. Such beverages containing phosphoric acid etch the enamel of the teeth of experimental animals in the same manner as does citric acid. The problems involved

in the drinking of acid beverages are worthy of consideration, especially when these fluids are consumed for pleasure alone.

Much improvement in cookery is possible. The item most worthy of attention is the potato. It comprises roughly half of all the fresh vegetables and fruits used in the Navy. Much too often it leaves the galley as a soggy, unpalatable foodstuff.

The whole trend of modern cookery is toward quicker operations. All evidence indicates that the best conditions for the preservation of flavors and vitamins are those that provide brief cooking for the shortest time before foods are served.

The other essential of modern cookery is the use of the smallest possible volume of water so that this can be consumed with the foodstuff. The wastage of vitamins is heavy when cooking waters are discarded from vegetables or meats. Heavy losses also result when the liquors of such foods as canned peas or the syrups of canned fruits such as apricots are discarded.

The two items that contribute most to losses in calories are bread and fats. Men often take bread on their trays and then discard it. This loss is easily checked by administrative supervision. The loss of fats is a much more difficult problem. In some of the larger shore stations this loss of fat may amount to as much as a ton per day. Saving this fat involves the trimming of meat at the slaughter house, retrimming in the galley, and the design of menus to include enough pickled foodstuffs so that men will tend to eat more fat.

Among the minor but important wastage of foodstuffs are such items as chicken and turkey giblets. Overworked butchers tend to discard these items unless supervised. Cooks usually do not know how to use giblets except in gravy, and frequently spoil this meat by grinding instead of chopping it. Since giblets provide about 10 percent of the cooked meat of chicken, they represent an important economic as well as nutritional loss when they are discarded.

Among the losses encountered aboard ship are those resulting from improper storage. Excellent bulletins are available on proper storage. An example of loss of potatoes from storage at temperatures that were too low, below 40° F., has come to our attention recently. The potatoes originally had been reserved for seed and stored at a temperature just above freezing before they were marketed for foodstuff. As a result the sugar content was too high. Storage at low temperatures aboard ship kept this sugar high. When these potatoes were cooked and served, the amount discarded in plate waste was very large because they were too sweet. This sugar could have been reduced if the potatoes had

been stored in a warm room for a couple of weeks before use. A knowledge of storage conditions is essential for preventing food wastage.

SUMMARY

Methods have been described for taking analytic samples in large messes. Data from such samples indicate the actual nutrients consumed today by men and women in the Navy. The trend of Naval diets is toward lighter meals and fewer calories. Beverages are important in the Naval ration. Milk consumption is increasing. Excessive use of acid beverages, such as synthetic lemonade and cola drinks, may be subject to question because of their possible effect on the enamel of teeth.

Better cookery will improve the nutritive value of the ration. This involves cookery for shorter periods, less holding of hot foods before service, and more use of cooking waters in the food. Such items as potatoes deserve much more attention in cookery in order to improve their palatability.

More nutritive value could be obtained from foods issued by decreasing the plate wastes, especially of such foods as bread and fats. More attention to optimum conditions for cold storage would also materially reduce losses. The prevention of the discarding of such special foodstuffs as chicken giblets effects economies and increases the vitamins of the diet.

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REDUCTION OF COMPLETE TRANSVERSE FRACTURE OF EDENTULOUS MAXILLA

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and

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On reviewing the literature, very little is found on treatment of fractures of the edentulous maxilla, particularly when the patient has no upper denture. No reference to traction applied by a wire passed through the palate and out through the nose to an adjustable anchoring device has been encountered. This method will be described by presenting the case.

Case report.—On 10 January 1943, a woman age 61 years, weighing about 190 pounds, tripped and fell headlong down a flight of iron stairs against an iron rail in the basement. She was transported by ambulance to the hospital, arriving in a critical condition. Her face and neck were badly swollen, and the lower eyelids edematous. There was fracture of the maxillary and nasal bones. The patient was bleeding from the nose and mouth. The chest was tender and contused; in fact, the entire body was covered with ecchymoses. Both wrists were fractured and there was a large laceration below the right knee.

In spite of supportive treatment, the patient went into shock 2 days after admission. A transfusion of 450 cc. of whole blood was given and on the following day her general condition was much improved.

On 15 January she was taken to the x-ray laboratory but because of her obesity, swelling, and pain, it was impossible to posture the patient for satisfactory roentgenograms of the bones of the face. This examination did, however, reveal some of the fracture lines, and showed evidence of cloudiness of both maxillary sinuses. The trip to the x-ray laboratory upset the patient, so she was not disturbed again for 2 days, at which time a careful examination was made of her face and oral cavity.

The patient's face was still swollen and the lower eyelids were still edematous. The face was distorted, and the nose deflected to the left. The right naris was blocked and the left nearly so. Palpation revealed fracture of the nasal bones and nasal septum, with considerable comminution and crepitus over the anterior wall of the left antrum as shown diagrammatically (fig. 1A). There was a transverse horizontal fracture of the maxillae through the antrums and above the floor of the nose, and vertically through the suture line between maxillary and palatal bones, causing a crease at this area (fig. 1B). On the right side the fracture appeared to be below the root of the zygoma (fig. 1C). On the left side it passed upward through the intra-orbital ridge, floor of the orbit, and through the outer orbital plate about

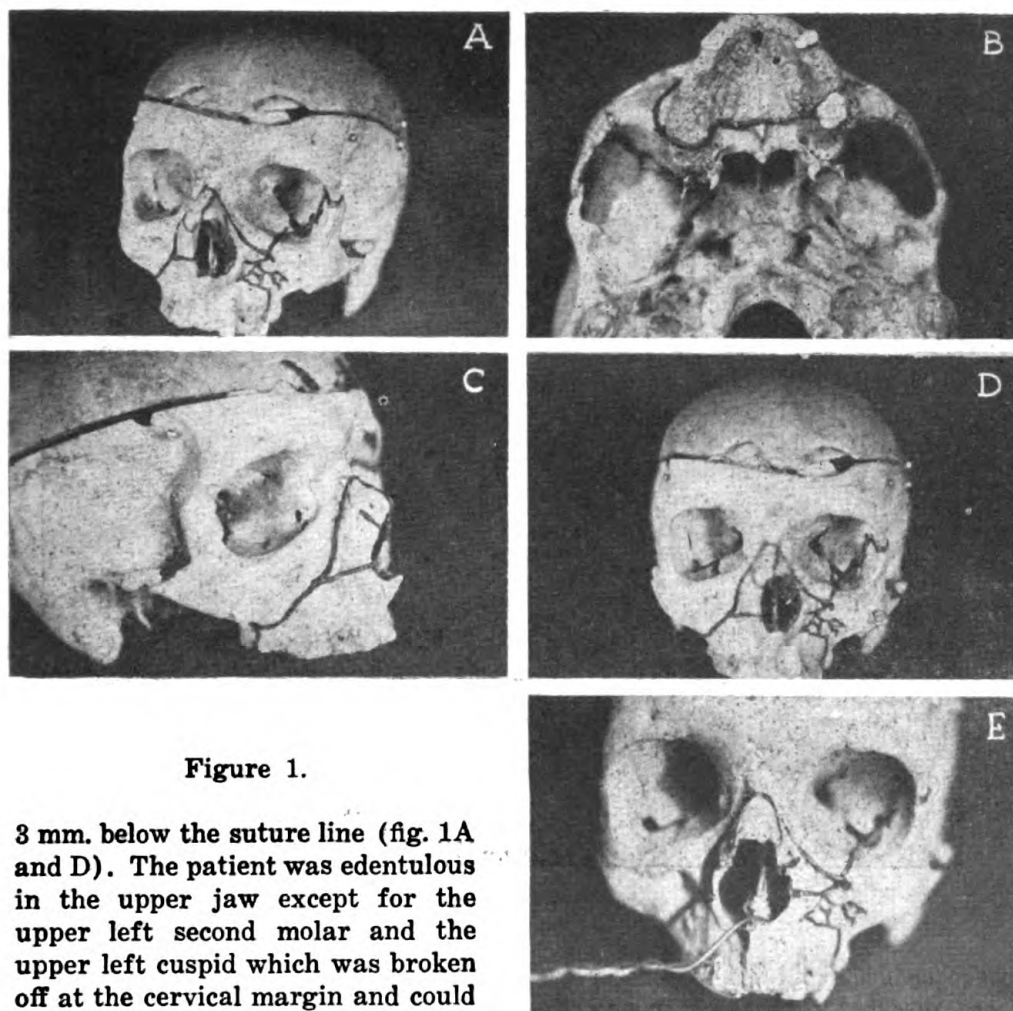


Figure 1.

3 mm. below the suture line (fig. 1A and D). The patient was edentulous in the upper jaw except for the upper left second molar and the upper left cuspid which was broken off at the cervical margin and could not be used as an anchorage point for traction.

The transverse fracture through the palate occurred just anterior to the second molar, which apparently resisted the force of the impact, causing the fragment to be deflected and to pierce the gum tissue at this point. Fortunately the fragment was essentially in one piece, except for some comminution along the edges and over the anterior wall of the left antrum. The main fragment was driven backward, downward and to the left.

The mandible was intact, but the right central and lateral incisors had been evulsed, and the left incisors were so loosened that they could be lifted out with the fingers.

The possibility of inserting stainless steel pins externally, or small screws intra-orally, was considered and discarded. It was decided that some form of external traction was necessary. A plaster head cap was applied and an anchoring device previously described¹ imbedded in it over the forehead. From this device a variety of traction and pressure supports could be arranged.

On the following day, 18 January, the patient was given avertin anesthesia, the board and bandage splints were removed and the fractured wrists

¹ STEVENSON, H. N.: Clinical Notes: Anchoring instrument for head fractures. Arch. Otolaryng. 40: 503, December 1944.

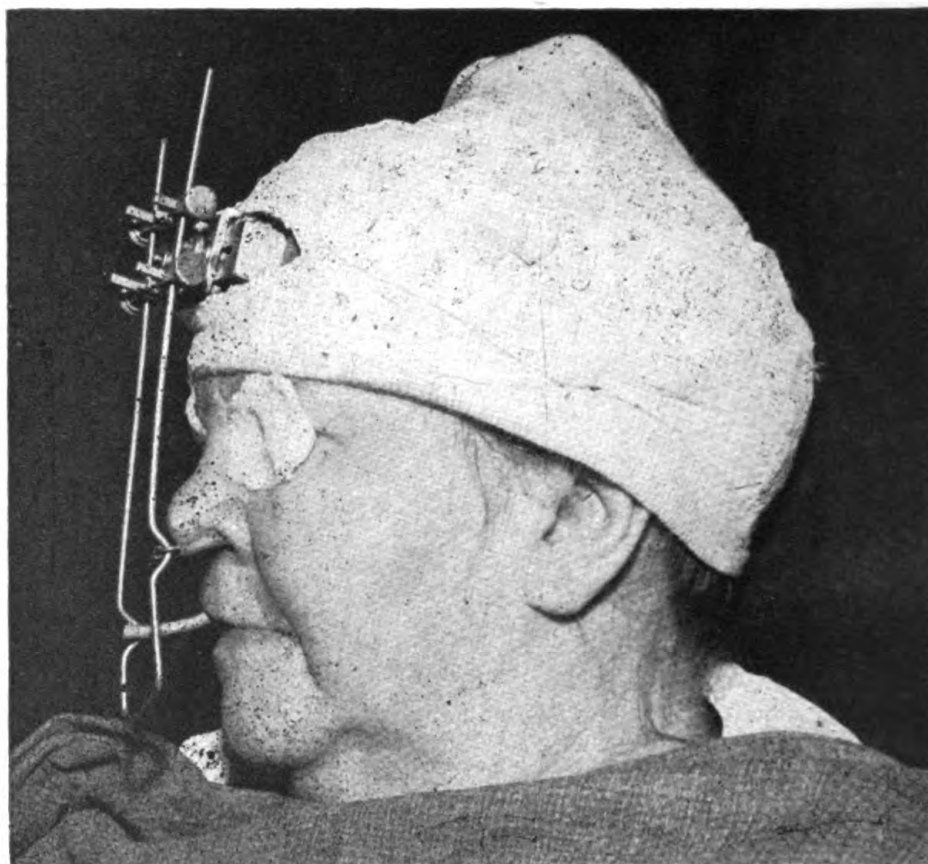


Figure 2.

were reduced and set in plaster casts. A tampon with cocaine hydrochloride was inserted into the left nostril, and a few drops of 2-percent procaine hydrochloride with cobefrin were injected into the left side of the palate. With a small surgical drill in a contra-angle handpiece, a small hole was drilled through the palate at a point about 0.5 cm. from the midline, and about 1.5 cm. distal to the crest of the anterior alveolar ridge (fig. 1B). Care was taken to enter the nasal cavity, and not the nasal septum, and at the same time not to injure the inferior turbinate or the structures of the anterior palatine foramen.

The hole was then enlarged to accommodate a 13-gage soft brass wire. This was introduced into the mouth and through the drilled hole into the left nasal cavity and drawn out through the nose (fig. 1E). A piece of soft rubber catheter tubing was then placed on each strand and forced to the hole in the palate and nose, and allowed to extend about 1 inch outside the nose and lip. This was done to pad the wire, thereby reducing pressure and preventing maceration of the soft tissues.

The long free ends of the wire were grasped, and the fragment pulled upward and forward and to the right. The wires were then passed around the bar suspended from the anchoring device secured in the headcap. Despite the fact that the accident had occurred 9 days previously, the fracture was completely reduced at this time (fig. 2).

The over-riding of the palate fragment disappeared, and this fragment, together with the maxilla, came into good position. In addition this manipu-

lation corrected the displacement of the fracture through the nasal septum and nasal bones. The occlusion of the external nares was relieved. No special intranasal support was required and there was no need for nasal packing.

During the period of healing, traction was maintained forward, upward and to the right as when applied. The re-adjustment of this traction was easily accomplished by loosening the thumb nuts on the anchoring device. Thus the supporting wires could be moved a little to increase or decrease the tension or change its direction. It was necessary to adjust the traction in this manner on four different occasions during the healing period. The ease with which the tension could be adjusted added greatly to the comfort of the patient. In addition this control eliminated the accidental disturbance of the fracture fragments; healing was greatly facilitated.

Before the fracture was reduced, the patient had complained of headache and considerable pain about the face and mouth. After reduction was accomplished, these symptoms promptly disappeared, along with the edema about the face. However the patient complained of excruciating pain in the wrists during the first week following the operation, and it is possible that this pain overshadowed any pain present about the face.

Aside from a few minor adjustments of tension, the patient required very little attention. Occasionally a drop of 10-percent argyrol or 1-percent methylene blue was placed in the floor of the nose as a prophylactic measure to prevent infection of the tissues adjacent to the wire passing through the palate.

On 13 February a few drops of cocaine hydrochloride were placed on the floor of the nose where the wire emerged from the mouth. The ends of the wire were removed from the traction appliance and cut inside the mouth close to the palate to facilitate removal from the nose. This wire was removed, the perforation in the palate was swabbed with tincture of merthiolate, and the lining tissue gently removed with a curette. The patient's mouth was kept open for 8 minutes to prevent contamination of the blood clot, and a circular disk of three thicknesses of gauze, $\frac{1}{2}$ inch in diameter, soaked in collodion, was placed on the palate to seal the perforation and protect the blood clot. This was removed after 2 days, at which time a well organized clot sealed the opening. By the end of the week, healing was so complete that it was difficult to detect the area of perforation.

This case demonstrated that a hole can be drilled through the superior maxilla from the mouth into the nasal chamber, that a 13-gage brass wire can be passed through a small hole and used as traction to bring fractured bones into correct position, and that no evident necrosis or injury to the bone is caused by this procedure. It is hoped that this method, or some modification of it, may help others confronted with the same or similar problems.

TREATMENT OF BACILLARY DYSENTERY CARRIERS WITH SULFONAMIDES

EPIDEMIOLOGY UNIT No. 40¹

In March and April 1944, an epidemic of bacillary dysentery occurred in the Marine division to which this epidemiology unit was attached. Organizations of the division, returning from a combat area in the Central Pacific, conveyed the infection to the base camp.

Included in the procedures for the immediate control of the epidemic was a compulsory stool culture on all mess personnel (cooks, bakers and messmen) of the organizations initially involved, and later on all such personnel of the entire division. Those with a positive culture were immediately removed from this duty and considered as carriers. All replacements, before being permitted to work in any galley or messhall, were required to have a negative stool culture report. Shortly after this program was inaugurated, an Army Epidemiological Unit offered its assistance and performed a stool culture on every man in the organizations in which the epidemic was occurring. From 14 March through 26 March, a total of 372 carriers had been isolated by this method.

Initially all carriers were hospitalized and treated by the local Army station hospital, but on 27 March, the Medical Battalion of this division arranged to treat this group in a designated quarantine area within the limits of the camp. At this time this Epidemiology Unit secured permission to organize and conduct a program designed to compare the effectiveness of the available sulfonamides in the treatment of these carriers. It is the purpose of this report to analyze the results obtained in the treatment of 327 of these carriers from 27 March to 5 May 1944.

The rectal swab method for obtaining fecal material was utilized for all routine stool cultures. S-S agar was unobtainable at this time and therefore sodium desoxycholate citrate was the selective medium used. All suspected cultural results were checked and confirmed by agglutination with specific diagnostic antisera. The organism responsible for this epidemic, and the only one iso-

¹ Personnel of this unit include the following: Lieutenant Ralph W. Getty (MC) U.S.N.R.; Chief Pharmacist's Mates Frank Clifton and Raymond Haringa U.S.N.R.; and Pharmacist's Mates, first class, J. Max Rukes and Stanley Rosch U.S.N.R.

lated by this unit, by the Army unit and by the laboratory at the Army hospital, was *Shigella paradysenteriae*, variety Flexner, type W.

It was decided to divide the carriers into three groups, those treated with sulfathiazole, sulfaguanidine, and sulfadiazine. A fourth group consisting of nontreated carriers was desired but was impossible from the military viewpoint which required men to be returned to duty as soon as possible. Unfortunately from the statistical viewpoint the first subjects admitted to the quarantine area were 221 carriers in whom treatment with sulfaguanidine had been previously started at the Army hospital. Following this all new admissions were either placed in the sulfathiazole group or the sulfadiazine group, but these groups never became as large as was desired for comparison purposes.

Following completion of the course of therapy each man received a stool culture on the fifth, seventh, and ninth days after the date of last medication. In addition to these a number of carriers in each group received an extra culture taken 24 hours or less after the last medication. When this extra culture was used the sodium desoxycholate citrate medium contained 0.005-percent para-aminobenzoic acid. Carriers were considered cured only if they had three consecutive negative cultures and were symptom free. Those who did not qualify received a repeat course of therapy which, regardless of previous drug, was sulfadiazine. On those requiring a repeat course, none of the three routine check cultures was positive following treatment. The results obtained with each sulfonamide are discussed separately.

Sulfathiazole.—Carriers in this group received a total of 29 gm. in a 7-day period (initial dose 2 gm., then 1 gm. four times a day for a total of 29 gm.). As shown in table 1, 55 carriers were treated. All received the extra para-aminobenzoic acid culture and the 3 routine check cultures. Eight of the 220 cultures done were positive, which represented 7 of the cases (1 carrier had 2 positive cultures), or 12.73 percent had at least 1 positive culture.

TABLE 1.—Results of stool cultures on carriers treated with sulfathiazole*

No. carriers treated	Positive cultures Days after treatment				No. carriers positive one or more times	Total no. cultures
	0-1	5	7	9		
48	0	0	0	0	0	192
1	1	0	0	0	1	4
1	1	0	0	1	1	4
3	0	0	3	0	3	12
2	0	0	0	2	2	8
55	2	0	3	3	7	220

* Treated with 29 gm. in 7 days.

Sulfaguanidine.—Carriers in this group received a total of 73.5 gm. in a 7-day period (3.5 gm. every 8 hours for a total of 73.5 gm.). As shown in table 2, there were 221 carriers treated. Of these, 59 received the extra para-aminobenzoic acid culture and the entire group the 3 routine check cultures. Eighteen of the 727 cultures taken were positive. This represented 15 of the cases (3 carriers had 2 positive cultures each), or 6.79 percent had at least 1 positive culture.

TABLE 2.—Results of stool cultures on carriers treated with sulfaguanidine*

No. carriers treated	Positive cultures Days after treatment				No. carriers positive one or more times	Total no. cultures
	0-1	5	7	9		
59	0	0	0	0	0	236
2	2	0	0	0	2	8
1	1	1	0	0	1	4
1	0	0	1	1	1	4
1	0	0	0	1	1	4
147	—	0	0	0	0	441
3	—	3	0	0	3	9
1	—	1	1	0	1	3
6	—	0	6	0	6	18
221	8	5	8	2	15	727

* Treated with 73.5 gm. in 7 days.

Sulfadiazine.—Carriers in this group received a total of 29 gm. in a 7-day period (initial dose 2 gm., then 1 gm. four times a day). In table 3 it will be noted that the first 49 had the extra para-aminobenzoic acid culture done and the routine check cultures. The next 2 had the 3 routine cultures and the last 19 had less than 3 routine cultures. At the time the military situation made it imperative that this latter group be returned to duty at once, and therefore, as these men were symptom free, it was necessary to assume that they were free from infection on the basis of one or two negative cultures. However because this assumption could have been inaccurate, only the first 51 cases will be included. Six of the 202 cultures included were positive. This represented 3 cases (one was positive once, another twice, and the third had 3 positive cultures), or 5.88 percent had at least 1 positive culture.

Four months later, following another combat period, compulsory stool cultures were again made on all mess personnel in order to prevent a recurrent epidemic of bacillary dysentery. This time 30 carriers of the same organism previously found were detected. These carriers were treated with 21 gm. of sulfadiazine over a 5-day period. Stool cultures were taken on the third, fifth, and seventh days after treatment and were negative in all cases.

A summary of the results obtained in this series is given in

TABLE 3.—*Results of stool cultures done on carriers treated with sulfadiazine**

No. carriers treated	Positive cultures Days after treatment				No. carriers positive one or more times	Total no. cultures done
	0-1	5	7	9		
46	0	0	0	0	0	184
1	0	1	1	0	1	4
1	0	1	1	1	1	4
1	0	0	0	1	1	4
2	—	0	0	0	0	6
**4	—	0	0	—	0	**8
**15	—	0	—	—	—	**15
51	0	2	2	2	3	202

* Treated with 29 gm. in 7 days.

** These carriers not included in the totals as they had less than 3 cultures after treatment.

tables 4 and 5. It is shown that 12.7 percent of the sulfathiazole group, 6.8 percent of the sulfaguanidine group, and 5.9 percent of the sulfadiazine group had one or more positive stool cultures following therapy.

TABLE 4.—*Summary, by medication and time of culture, of stool cultures on carriers*

	No. of days after treatment				Total no. of cultures	No. of carriers
	0-1	5	7	9		
Total cultures:						
Sulfathiazole.....	55	55	55	55	220	55
Sulfaguanidine.....	64	221	221	221	727	221
Sulfadiazine.....	49	51	51	51	202	51
Positive cultures:						
Sulfathiazole.....	2	0	3	3	8	7
Sulfaguanidine.....	3	5	8	2	18	15
Sulfadiazine.....	0	2	2	2	6	3
Percentage positive:						
Sulfathiazole.....	3.64	0.00	5.45	5.45	3.64	12.73
Sulfaguanidine.....	4.69	2.28	3.62	0.90	2.48	6.79
Sulfadiazine.....	0.00	3.92	3.92	3.92	2.97	5.88

TABLE 5.—*Summary, by medication, of stool cultures on carriers*

Drug	No. of carriers	No. of cultures on each	Carriers positive one or more times	Percentage positive
Sulfathiazole.....	55	4	7	12.73
Sulfaguanidine.....	{ 64	4	5	7.81
	{ 157	3	10	6.37
Total.....	221	.....	15	6.79
Sulfadiazine.....	{ 49	4	3	6.12
	{ 2	3	0	0.00
	{ *4	2	0	0.00
	{ *15	1	0	0.00
Total.....	51	.....	3	5.88
Total all drugs.....	327	.....	25	7.65

*These 10 carriers not included in the total as they had less than 3 cultures after treatment.

To evaluate these percentages properly, it is necessary to subject them to statistical analysis. By taking the measure of significance at 0.1 and using the formula for the standard error of the difference between two percentages, it can be shown that no significant statistical difference exist between any of the results obtained. This means, in effect, that the actual differences in the results obtained with these sulfonamides could have been due to chance.

CONCLUSIONS

A total of 327 carriers resulting from an epidemic of *Shigella paradysenteriae*, variety Flexner, type W were treated with sulfonamides. Of these, 55 were treated with 29 gm. of sulfathiazole, 221 were treated with 73.5 gm. of sulfaguanidine, and 51 were treated with 29 gm. of sulfadiazine. Stool cultures were done on all carriers on the fifth, seventh and ninth day following treatment and approximately one-half had an additional culture 24 hours or less after the last medication. Circumstances did not permit a determination for the duration of the carrier state without treatment. Statistical analysis did not reveal significant differences in the results obtained for eradicating the carrier state for this organism with the sulfonamides and dosages used in this series.



INFECTIOUS ASTHMA

Infectious asthma has the following characteristics: Symptoms begin in a patient previously well until he contracts an acute respiratory infection with fever, purulent discharge from the nose, and cough with or without purulent sputum. It is described as "flu" or "grippe" or a "deep cold." Asthma often begins weeks or months after the acute phase of the respiratory infection, although cough and purulent anterior or posterior nasal discharge persist. Subjective unilateral preponderance of nasal stuffiness is the rule. Cough precedes and dominates the attacks. When cough is productive, purulent sputum is raised. The nasal mucosa is red and swollen. Mucopurulent strands bridge one or both nasal cavities. Pus is common in the middle meatus after shrinkage. The antra or frontals may transilluminate unequally. Red streaks of lateral pharyngitis indicate the affected side. The paucity of atopic leads in the history and skin reactions is striking. Troublesome exacerbations are accompanied by fever and leukocytosis.—EDITORIALS: Classification of asthma. *J. Allergy* 16: 199-200, July 1945.

PENICILLIN IN OTITIS MEDIA

TREATMENT OF THE DISEASE AND ITS COMPLICATIONS

SIGURD von CHRISTIERSON

Commander (MC) U.S.N.R.

An unusually severe epidemic of hemolytic streptococcal upper respiratory disease was experienced in one of the large Naval training centers during the winter of 1943 and 1944. This report is concerned only with cases of otitis media in patients admitted to the hospital for this reason, or of cases developing in patients who were in the hospital for other causes, such as scarlet fever, measles, rheumatic fever, and pneumonia. It does not include the numerous cases successfully treated in the seven dispensaries on the station. Consequently the percentage of mastoiditis to otitis media here reported is much greater than its actual incidence at the training center.

The period covered by this report is from 1 August 1943 to 1 August 1944. During this time, as shown in table 1, there were 1,219 patients with acute otitis media treated, 158 of whom developed surgical mastoiditis with 29 other grave complications as sequelae. Many patients were admitted to the hospital after as long as 6 weeks following the onset of otitis media, and many had obvious signs of mastoiditis on admission. All the patients received sulfonamides in full doses from the time of admission or onset, except those who had a definite history of sensitivity to the drug.

Treatment was continued until the appearance of drug reaction, which was not uncommon, or in the uncomplicated cases until the symptoms of otitis media disappeared. It was continued following mastoidectomy until fever had disappeared and the wound showed normal, uncomplicated healing.

It was noted independently by different members of the staff that whereas sulfonamide therapy had produced satisfactory results in cases of otitis media treated prior to January 1944, after that time there was practically no response to the drug. Symptoms of mastoiditis progressed as though no medication had been given. However the symptoms were masked with low-grade fever, until x-ray examination showed extensive destruction of the mastoid process, a subperiosteal abscess formed, or a sudden chill and

vomiting with headache revealed how far the infection had progressed. At operation these mastoids showed tremendous destruction, with erosion of the sinus wall or dural plate and peri-sinus or epidural abscess. This lack of effect of the sulfonamide drug was the source of great concern.

By March 1944 the incidence of otitis media had increased to such an extent that there were over 150 cases in the hospital at one time. Reference to table 1 shows that the percentage of those who developed mastoiditis requiring operation rose to the alarming proportion of 26.5 percent in January and of 27.6 percent in April. More sinister was the severity of the complications of mastoiditis that ensued. In August there were none; in September there were 2 cases of facial paralysis; in November 1 case; and in January there were 3 lateral sinus thromboses, 1 case of meningitis and 3 of labyrinthitis. In February 1945 there was 1 sinus thrombosis, 1 cerebellar abscess, 1 meningitis, 1 encephalitis, and 1 erysipelas. March had 3 sinus thromboses, 1 erysipelas and 2 labyrinthitis cases, and April had 1 sinus thrombosis, 1 brain abscess, 2 cases of meningitis and 1 of encephalitis. Then the complications dropped dramatically. The only complications occurring in May were in a patient who on admission had obvious signs of meningitis and sinus thrombosis. June had none; July had one. In April 34 mastoidectomies were done, representing 27.6 percent of all otitis media cases in the hospital at that time.

TABLE 1.—Incidence of surgical mastoiditis and complications of otitis media

Month	Otitis media	Mastoidectomies	Percent	Complications
August 1943.....	51	2	4.0	0
September.....	91	7	7.7	2
October.....	64	1	1.7	0
November.....	58	5	8.6	1
December.....	123	17	13.8	0
January 1944.....	113	30	26.5	7
February.....	120	20	16.6	5
March.....	186	23	12.4	6
April.....	123	*34	27.6	5
May.....	113	7	6.2	2
June.....	87	6	6.8	0
July.....	90	6	6.6	1
Totals.....	1,219	157	12.9	29

*One patient who had mastoiditis with cerebellar abscess and petrositis was not operated upon.

Previous to this time penicillin had been very difficult to obtain and therefore was only available to very seriously ill patients. The severity of the ear infections and the frequency of dangerous complications demanded drastic preventive action. Permission was requested and obtained to use penicillin in all acute cases of otitis media which showed no beneficial response to sulfonamide therapy in a relatively short time. On 22 April a program of

penicillin therapy was begun on that basis. Penicillin was given to all patients with otitis media in whom the sulfonamides had showed no effect in from 5 to 7 days, or in whom mastoiditis was suspected or obviously present on admission.

In April there were, as has been stated, 34 mastoidectomies, representing 27.6 percent of the otitis media incidence, with 5 severe complications. During May seven mastoidectomies were done, comprising 6.2 percent of the otitis media incidence. Of these patients all but one had had symptoms and signs of surgical mastoiditis on admission. None had received what was considered to be an adequate course of penicillin prior to surgery. The only complications occurring that month were sinus thrombosis and meningitis, present on admission in the same patient. The month following gave comparable figures. Since the beginning of the penicillin program in April, only four patients who had received adequate penicillin treatment developed surgical mastoiditis. By adequate treatment is meant that penicillin was begun before the appearance of signs and symptoms of mastoiditis, and continued for at least 4 days before such symptoms appeared.

Prior to April penicillin had been given postoperatively for the various serious complications mentioned, as well as for postoperative toxemia which was not uncommon. In nearly all instances the response was remarkable, the temperature falling rapidly, the wound becoming healthy, the mind clearing, positive cultures becoming sterile, and the general condition improving usually within 48 hours and often within 24 hours. In these cases penicillin was given by an initial dose of 100,000 units in 1,000 cc. of normal saline solution intravenously over a period of 8 hours. This was followed by 50,000 units daily, in equally divided doses every 3 hours intramuscularly, and continued usually for from 4 to 6 days until definite improvement was certain. The dosage was then reduced to 25,000 units daily, intramuscularly, and continued for another week or two depending upon healing and general improvement.

In a few instances the penicillin was discontinued too early, with resulting elevation of temperature, fouling of the wound and return of toxic symptoms which responded quickly upon resumption of penicillin therapy. In all patients except those with meningitis, sulfadiazine therapy was discontinued when administration of penicillin was started. Meningitis was treated on the contagious ward. As soon as the diagnosis had been established by spinal puncture, 20,000 units of penicillin in 12 cc. of normal saline solution were given intrathecally daily. In addition 100,000 units were given daily intramuscularly in divided doses every 3 hours. At the same time an initial dose of 5 gm. of sulfadiazine

TABLE 2.—*Effect of penicillin compared with sulfadiazine in 42 consecutive cases of uncomplicated otitis media*

	Days on sulfadiazine		Days on penicillin		Days till dry	
	Average	Range	Average	Range	Average	Range
A 18 patients* on sulfonamide only.....	18	6-45	None	None	16	3-45
B 17 patients on sulfonamide followed by penicillin.....	15	4-40	9	3-19	7	2-19
C 7 patients on penicillin only.....	None	None	11	5-19	9	4-18

*In the group of 18 cases, 9 responded well to the drug, the ears draining in less than 2 weeks, with an average of 7 days. Only 3 ears ceased draining during the third week and 6 took from 3 to 6 weeks to become dry.

in 120 cc. of distilled water was given intravenously. This was followed by 5 gm. of sulfadiazine in 1,000 cc. of Hartmann's solution or in saline, by clysis three times a day. As soon as the patient was able to swallow and the blood sulfonamide level was up to 15 to 20 mg. per 100 cc., 1 gm. of sulfadiazine was given by mouth every 3 or 4 hours. The dosages of both sulfadiazine and penicillin were reduced as the patient became symptom free, and the taps were discontinued when the fluid became clear. All medication was stopped in about 7 to 10 days thereafter.

Mastoidectomy was sometimes postponed for from 1 to 3 days when the patient's condition was critical, and it is believed that this preoperative medication often reduced the surgical risk. The patients with acute otitis media who were treated with penicillin after 22 April received 50,000 units daily intramuscularly and this dosage was continued for from 5 to 7 days, when it was reduced to 25,000 units daily until 2 days after the ear was dry. Of these patients, four developed mastoiditis requiring operation, the mastoid showing destruction at operation, but cultures of the aural discharge were sterile and the discharge was not purulent. Recovery was universally uneventful, and the healing period was possibly shortened somewhat by use of the drug. Penicillin was not used locally.

A comparative study was made by Dassler on 42 consecutive cases of uncomplicated acute otitis media with recovery, and although a short series, it is believed of interest. As seen in table 2, 18 patients were treated successfully with sulfadiazine alone. Immediately after myringotomy, they were given 2 gm. of sulfadiazine with sodium bicarbonate, and thereafter 1 gm. every 3 hours night and day. Complete recovery occurred in 16 days average time, and treatment was continued 2 days after recovery, with an average of 18 sick days. Seventeen patients were treated with sulfadiazine for an average of 15 days, when the drug was discontinued because of failure to obtain response and penicillin

was substituted. These patients recovered in an average of 7 days after starting penicillin; seven patients given penicillin immediately recovered in an average of 9 days. It is thus seen that there was no appreciable difference in the response of the patients who had prolonged sulfonamide therapy and of those who received penicillin from the beginning.

It is regretted that no comparative study was made of the effect of penicillin alone and of penicillin in conjunction with sulfonamide therapy. Recently published reports, however, strongly indicate that combined therapy is definitely the most effective, and experience here supports this opinion. Especially notable was the successful treatment of otitic meningitis by combined therapy as previously discussed.

SURVEY OF COMPLICATIONS

Lateral sinus thrombosis.—Ten cases were diagnosed in this series. All the patients with this condition had chills, spiking temperatures, average leukocyte counts of from 17,000 to 35,000, with a polymorphonuclear average percentage of eighty-seven. Blood culture was positive for hemolytic streptococci in seven cases. The Queckenstedt test was positive in 6 cases. Only one patient was operated upon, a mastoid abscess having formed. The internal jugular vein was ligated in 7 instances. In three cases ligation was not resorted to as all symptoms disappeared following penicillin therapy and mastoidectomy. Three cases were associated with meningitis.

Brain abscess.—Two patients developed cerebellar abscess. One case followed an abscessed sinus thrombosis which was evacuated and the jugular vein ligated. Symptoms of cerebellar abscess appeared shortly thereafter and, following 6 weeks of treatment with combined penicillin and sulfadiazine, the abscess was successfully drained, with recovery of the patient except for a residual ataxia.

The other patient was not seen on this service before autopsy and therefore properly should not be included in this series. However the case occurred during the period covered by this report and at the same activity. Myringotomy had been done 2 weeks previously, with normal healing of the ear drum, and the patient had been treated with sulfadiazine. He died 12 hours after symptoms of headache, elevation of temperature, vomiting and convulsions occurred. Autopsy revealed a healed ear drum, evidence of necrotic petrositis with an adjacent localized meningitis, and massive cerebellar abscess.

Facial paralysis.—This complication occurred in three patients, appearing within the first 7 days after onset of otitis. Two pa-

tients had mastoidectomies performed and the condition disappeared after operation. In the third patient the paralysis occurred 24 hours after myringotomy. There was discharge from the ear for 4 days followed by healing of the drum and return of hearing; mastoidectomy was deferred. The paralysis gradually disappeared but after 2 months there was still a residual palsy.

Otitic meningitis.—There were five patients with otitic meningitis, all but one of whom had mastoidectomies performed. The spinal fluid cell count varied from 800 to 32,000. These patients all received treatment as previously outlined. The one patient who was not operated upon developed meningitis on the fifth day of otitis media and showed no symptoms of mastoiditis. His meningeal symptoms subsided in 24 hours and the ear was dry 4 days after the penicillin and sulfonamide therapy was begun. Recovery was complete in 14 days. The conclusion is that if meningitis develops early in the course of otitis media, mastoidectomy is not necessarily indicated. Three patients had accompanying later sinus thrombosis.

Encephalitis.—Two cases were observed. These patients presented symptoms simulating meningitis; these included meningismus, headache, vomiting, aphasia, lack of coordination and orientation, chills and fever. Both patients were confused mentally and one became unconscious with convulsions. One had a positive blood culture. Both had negative spinal fluid cell counts. Symptoms disappeared 48 hours after operation and administration of penicillin therapy.

Labyrinthitis.—This disturbing complication occurred preoperatively in three cases and postoperatively in two. It was evidenced by violent vertigo with vomiting on slightest motion. Second- and third-degree nystagmus was present in all patients; in two it was rotary and in three horizontal. The vertigo usually disappeared after 2 or 3 days of penicillin therapy; the nystagmus persisted for several days, in one patient as long as 12 days.

Erysipelas.—Only two cases of erysipelas were encountered, and although this is not a serious complication, they are included because penicillin therapy made the patients comfortable and checked the progress of the infection within 24 hours; all signs of swelling and redness were gone in 3 days.

COMMENT

Cultures from the mastoids at operation were sterile in about 10 percent of cases. The predominant organism found was hemolytic streptococcus, although *Staphylococcus aureus* occurred in two cases and pneumococcus in six. X-ray therapy was tried in

approximately 25 cases with no definite improvement, although admittedly it was used late in the development of mastoid symptoms. The impression was that it produced increased oozing of blood from the bone at operation but had no deleterious effect on healing.

Five patients with mastoiditis were observed who showed unmistakable indications for surgery, namely, progressive elevation of temperature and blood count, x-ray evidence of destruction, more purulent aural discharge with periostitis of the ear canal, and considerable postauricular edema. All of these patients recovered without surgical treatment after penicillin therapy. One of these was in the sixth week of otitis and roentgenograms showed evidence of extensive destruction. One case of urticaria occurred in the third week of penicillin treatment and promptly disappeared when penicillin was discontinued, therefore being considered as a toxic manifestation of the therapeutic agent. This was the only toxic effect of penicillin observed.

The duration of otitis media before mastoidectomy was an average of 27.9 days. Unfortunately data are not available to show the number of postoperative days before complete healing. The number of days spent in the hospital postoperatively averaged forty-three. The latter period appears abnormally long, but it includes not only the period of healing but also the period of convalescence, as these patients had to be fit for duty when discharged and many were gravely debilitated. It does not include the patient with the brain abscess who was in the hospital for 6 months.

The number of days on sulfadiazine therapy preoperatively averaged 13.9. The average duration of penicillin therapy was 12 days. There were no deaths. All these patients were returned to full duty except the patient with the brain abscess. The other obvious sequela was the residual facial palsy which had not completely disappeared on discharge of the patient. About 7 percent of the patients had a residual dry appearance of the tympanic membrane. Routine hearing tests were unfortunately not made after recovery of the patients, but no incapacitating deafness resulted.

PENICILLIN IN THE TREATMENT OF STREPTOCOCCAL EMPYEMA

CECIL J. METCALF

Lieutenant Commander (MC) U.S.N.R.

This report is confined to 37 cases of empyema treated at a large Naval dispensary between 1 January and 16 November 1944. There were many more patients than these who developed pleural effusion as a complication of pneumonia; however no case which was not definitely suppurative is included in this series. Eight of the 37 patients required surgical drainage.

It is significant in this series that the organisms cultured were *Streptococcus viridans* and *Streptococcus haemolyticus*. In three instances the fluid had the appearance of that caused by the pneumococcus but the culture proved the presence of streptococci. In 12 patients the fluid was sterile from the onset; this is probably attributable to the chemotherapy used in the treatment of the intercurrent pneumonia.

Because of the prolonged course of the disease in patients treated by surgical drainage, and the delay in the formation of adhesions and the fixation of the mediastinum in streptococcal empyema,¹ it was decided to aspirate early and frequently, hoping that adhesions between the visceral and parietal pleura would form early and produce a small cavity at the base. Aspirations consequently were done daily until the amount of fluid obtained was less than 200 cc., after which paracentesis was performed every second or third day until the cavity was dry.

Ten patients were treated with intrapleural penicillin alone; two with intramuscular penicillin alone; nine received both intramuscular and intrapleural penicillin; eight received no penicillin; and eight patients were treated subsequently by surgical drainage.

There was no appreciable difference in the length of time required for the cavity to become dry between the four groups treated by aspiration.

Originally 30,000 units of penicillin were instilled in the pleural cavity at the termination of the aspiration, later 20,000 units were used. It was found that 48 hours after 20,000 units of peni-

¹ STRODE, J. E.: Consideration of empyema, especially its chronic phase. *Surgery* 13: 598-609, April 1943.

TABLE 1.—Average number of days required for cavity to become dry

Group	From appearance of fluid (days)	From first aspiration (days)	From start of treatment until temperature became normal (days)
1. Intramuscular and intrapleural penicillin...	41.7	37.5	4.5
2. Intramuscular penicillin.....	24.0	22.5	10.5
3. Intrapleural penicillin.....	49.7	42.5	7.8
4. No penicillin.....	42.7	37.5	7.2

cillin had been instilled, the pleural fluid contained a therapeutic concentration. This was also the case in 24 hours after 10,000 units had been instilled. One patient not included in this report had a pleural fluid which was relatively free of fibrin and exudate, and the penicillin was absorbed in this instance too rapidly for any to be recovered after 24 hours, even when 20,000 units had been instilled.

It is apparent that fibrin and exudate retard the absorption of penicillin. This is in agreement with the findings of Tillett et al.² No penicillin was recovered from the pleural fluid when it had been administered intramuscularly only. Because of these observations on pleural fluid assays, instillation of 20,000 units of penicillin into the pleural cavity after each aspiration became routine, followed by 5,000 units intramuscularly every 3 hours until the temperature had been normal for 24 hours and the cultures were sterile.

In two patients encapsulated pockets of pus too thick to aspirate were irrigated with saline. From x-ray studies it was seen that the cavity completely disappeared after two irrigations in one patient and after one irrigation in the other. This therapy warrants further trial in the future.

Several patients in whom the specific gravity of the fluid was high and the amount of sediment was over 50 percent were successfully treated by aspiration. It is therefore thought that these findings should not be used as indications for surgery as suggested by Strode, but rather reliance should be placed on the clinical and x-ray findings. In this connection it is well to remember that the physical and x-ray findings of fluid in the chest and a thickened pleura may be the same; and a diagnostic aspiration therefore should be performed when there is any doubt concerning the diagnosis. If the fluid re-forms too rapidly and there is too

² TILLET, W. S.; CAMBIER, M. J.; and MCCORMACK, J. E.: Treatment of lobar pneumonia and pneumococcal empyema with penicillin. Bull. New York Acad. Med. 20: 142-178, March 1944.

much fibrin to permit a complete aspiration of the fluid, surgery becomes necessary. The mediastinum, however, must be fixed and adhesions present between the pleural layers at the apex before surgery should be contemplated.

Empyemic patients are prone to develop a severe secondary anemia with emaciation. Therefore it is essential to get them out of bed as early as possible, even before the temperature is normal, if the general condition permits. A high caloric diet supplemented with vitamins and iron should be given. Aspirations are usually done between the eighth and ninth ribs in the posterior axillary line. It is preferable to have the patient sitting, using the head of the bed as a support. However if the patient is too weak, dyspneic and toxic to permit sitting during the paracentesis, the aspiration can be performed with him lying on the affected side and well over the edge of the bed. The equipment of choice is a 50-cc. Luer-lok syringe with a two-way Luer-lok stopcock. This eliminates all possibility of connections separating and allowing air to enter the pleural cavity. This happened in two instances and may have been a factor in the long postsurgical convalescence. Blunt needles of 18 or 15 gage are essential to prevent injury to the visceral pleura, with possibility of bronchopleural fistula and pyopneumothorax. Large amounts of fluid were removed at one sitting on several occasions with no ill effects. Aspiration should be stopped immediately if uncontrollable coughing is stimulated.

With the patient lying on his affected side, oxygen may be given either by mask or tent without interfering with the aspiration. Frequently oxygen is required for the respiratory embarrassment caused by the fluid.

On discharge, thickening of the pleura as observed by physical and x-ray examination was present in most of the patients. A diagnostic aspiration was done before discharge to rule out the presence of fluid. As many as possible of the patients were returned after 30 days for x-ray check-up; all showed the chest as clearing. No patient in this series was discharged from the service because of the empyema. All were returned to full active duty.

It should be pointed out that the average number of hospital days is necessarily long because these patients must be retained in the hospital until they can be returned to full duty. In civilian practice this type of patient may convalesce at home or be aspirated in the office.

Two patients were transferred to the medical service after their empyema was cured, one because of a concurrent pericarditis and the other because of a toxic neuritis. A third was transferred

to the eye, ear, nose and throat service for the removal of a pterygium. These three cases further increased the average number of hospital days.

SUMMARY AND CONCLUSIONS

Thirty-seven cases of streptococcal empyema are reported. Twenty-nine of these patients were treated by aspiration with and without the use of penicillin. The average number of hospital days for the aspirated cases was 84.5 days. Penicillin was beneficial in rendering the fluid sterile, in reducing temperature and toxicity, but not in shortening the course of the disease. Eight patients were treated surgically, with the average number of hospital days in excess of 167 days. Three are still in the hospital at this writing.

Many empyemic patients can be successfully treated by aspiration alone if the fluid is detected early and aspirated frequently. Daily and even twice-daily aspirations should be done until the 24-hour accumulation of fluid is less than 200 cubic centimeters.

Penicillin, 20,000 units intrapleurally after each aspiration and 5,000 units intramuscularly every 8 hours until the temperature is normal and the culture is sterile, is recommended until further knowledge of dosage is obtained by assay of the pleural field.

A closed apparatus should be used to prevent the possibility of air entering the pleural cavity, and a record of the fluid should be kept, noting the appearance, culture, cell count, specific gravity and the amount of sediment as a guide to the therapy. Frequent x-ray and physical examination is necessary.



CONTRAINDICATIONS TO THE USE OF DICUMAROL

Dicumarol is contraindicated in: (1) The presence of definite renal insufficiency, because renal insufficiency greatly prolongs and increases its effect; (2) the presence of definite hepatic insufficiency for the same reason; (3) purpura of any type because of the danger of bleeding when capillary weakness and impaired coagulation are both present; (4) subacute bacterial endocarditis because of the vascular weakness caused by the disease and therefore increased liability to hemorrhage; (5) blood dyscrasia with tendency to bleed; and (6) recent operation on the brain or spinal cord because of the grave consequence of even slight bleeding at the operative site.—BARKER, N. W.: Clinical use of dicumarol. *M. Clin. North America* 29: 929-935, July 1945.

PENICILLIN IN PRIMARY ATYPICAL PNEUMONIA

REPORT OF TWENTY-EIGHT CASES

STANTON T. ALLISON

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In a large Naval hospital over a period of three and one-half years it has been my privilege to study closely and, with the able assistance of other medical officers,¹ care for 1,013 patients with primary pneumonia. By primary pneumonia I refer to the disease pneumonia which arises spontaneously in an individual and is not a sequela of another disease. This series consisted of 426 pneumococcic lobar pneumonia patients, 378 primary atypical pneumonia patients, and 209 patients with bronchopneumonia.

In this series there were five deaths. Two of the deaths were in the primary atypical pneumonia group and it was because of these two deaths that this study was made. The other three deaths were not particularly noteworthy. Two of them occurred in pneumococcic lobar pneumonia patients who had reached the hospital too far advanced in their disease. The third had a *Staphylococcus albus* pneumonia in which every form of therapy in modern use in pneumonia cases failed completely. The two patients who died with primary atypical pneumonia, however, impressed us greatly. We felt absolutely powerless as we saw their disease progress unfavorably, rather rapidly in one patient and somewhat slowly in the other.

A nonhemolytic streptococcus was obtained directly from the lung at autopsy in one of these; in the second patient antibodies were found in the blood on the eleventh day of the disease, directed against this organism, the streptococcus MG. It was believed by us, as well as the Rockefeller observers² who first differentiated the streptococcus MG, that these patients had been first infected by a virus which paved the way for a secondary nonhemolytic streptococcus which was perhaps essentially non-pathogenic for man under normal circumstances but, because of the diseased conditions of the bronchial tree caused by the virus,

¹ Commander R. F. Solley (MC) U.S.N.R. and Lieutenant E. H. Loughlin (MC) U.S.N.R.

² Lieutenant Commanders Lewis Thomas, F. L. Horsfall, Jr., and G. S. Mirick (MC) U.S.N.R.

the organism now had become a virulent invader. It was observed that this nonhemolytic streptococcus MG was not affected in vitro by the sulfonamides but was killed by penicillin. Because of this we have used penicillin in all patients with primary atypical pneumonia who have appeared to be infected by this combination of virus and MG streptococcus, basing our diagnosis for this on the severity of their symptoms and, in some cases, obtaining blood in which antibodies were found directed against this organism.

In this series of 28 cases there were no deaths. The dosage of penicillin was 60,000 units initially (6 cc. in each buttock) and subsequent dosage of 30,000 units (6 cc. in alternate buttock) every 3 hours, day and night, until the temperature had dropped to normal and remained so for at least 3 days. Oxygen-tent therapy was given to the majority of these patients. No sulfonamides were used in this series.

The most striking symptom was dry cough. In some of these patients the cough was so irritating and so severe that it could not be controlled with even larger than ordinary doses of codeine. Morphine and dilaudid had to be resorted to in order to obtain a sufficient amount of rest for the patient. Headache and malaise were common symptoms. Pulse and respiratory rates were not as a rule much elevated, at least not until later in the disease. White blood counts usually were within normal range, although in five patients they were above normal. The roentgenographic appearance of the lung involvement varied from a minimal amount of infiltration, a faint hazy pneumonitis, to increased densities, at times being as dense as a pneumococcic lobar pneumonia shadow. In none of these cases could a pneumococcus be typed.

The temperature dropped by lysis in all cases but two. In one case there was some doubt as to whether this case was actually one of atypical pneumonia or whether we might be dealing here with a pneumococcic pneumonia. No typing was obtained, however, and the lung shadow persisted for a long period in spite of the drop in temperature. Accordingly the patient was kept on penicillin therapy for a considerable period. Nineteen of the patients received over a million units of the drug. The highest dosage in any one patient was 6,720,000 units. This patient was extremely ill and had a low-grade fever for 2 weeks after the most critical period of the disease had passed.

The febrile period following the advent of penicillin therapy averaged 7.5 days for the entire series. This appeared to differ very little from those virus pneumonia cases treated expectantly.

It would appear that penicillin probably has no effect on the virus process but does affect the secondary invaders, such as the

streptococcus MG. As it is the secondary invaders which very possibly cause the fatal outcome of the primary atypical pneumonia cases, it seems logical to conclude that penicillin should be used in those cases which appear not to respond to bed rest and ordinary supportive therapy, and in those cases which appear toxic upon admission.

CONCLUSIONS

Twenty-eight patients with primary atypical pneumonia were treated with penicillin. There were no deaths. The average febrile period after starting penicillin therapy was 7.5 days. This did not differ materially from other cases we have studied which have not received penicillin.

It is the belief that penicillin does not affect the virus infection but is a definite aid in combating secondary bacterial invaders.



PENICILLIN LOCALLY IN VINCENT'S ANGINA

Because Vincent's angina was an ever-present, although statistically small problem aboard ship, it was decided to resort to penicillin in its control. Lozenges were made as follows. To 200 cc. of bulk-flavored gelatine dessert powder was added 90 cc. of tap water. The mixture was heated slowly until the powder dissolved; the temperature was kept considerably below that of boiling water. To this 100,000 Oxford units of penicillin in from 10 to 20 cc. of water were added. The resultant mixture was stirred rapidly but thoroughly, poured into a standard ice-cube tray (without partitions), and immediately refrigerated. The standard ice-cube tray is 4 inches wide and 10 inches long. When the material jelled, it was cut into 40 squares about 1 inch on a side, and about $\frac{3}{8}$ -inch thick. Depending upon a uniform mixture, each block contained 2,500 units of penicillin.

The patient is instructed to allow the gelatinous block to melt in his mouth. Because only very little water is used in its preparation, each lozenge is quite firm and requires from 3 to 5 minutes to dissolve completely. The dosage is one every 2 hours. In the limited number of cases observed to date, it appears that penicillin used in this manner is a definite improvement over the older methods of treating Vincent's angina.—MANNING, G. C., JR., Lieutenant, junior grade (MC) U.S.N.

SUDDEN DECREASE IN CENTRAL VISION

ITS EMERGENCY NATURE AND TREATMENT

REINOLD WILLIAM ter KUILE

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The sudden onset of central visual blurring in one or both eyes, due to vascular spasm, is an emergency calling for prompt diagnosis and proper treatment. If this is not done permanent damage occurs in the macular nerve elements, and the central visual loss becomes permanent. Proper treatment with vasodilators, on the other hand; not only will stop the process but, if begun early enough, will restore vision to normal.

This fact has been amply demonstrated by more than 20 cases seen at the Eye Clinic of this Naval hospital during the past year. Of these cases, 5 patients were seen within the first week of the onset of visual blurring and before macular degeneration had begun. They were promptly treated with vasodilators; all of them recovered normal vision despite an extensive initial visual loss, and were returned to full duty. The remainder, or over 15 patients, were not sent to this hospital until several weeks or months had elapsed after the onset of central visual blurring. All of these had already suffered various degrees of permanent macular damage and as a consequence had a total loss of central vision which could not be improved by any means. These men were unable to return to duty.

The dramatic contrast between these two groups obviously demands a greater effort on the part of the medical officer to detect this condition, to initiate speedily proper treatment or to refer the case promptly to an ophthalmologist.

With few exceptions all patients giving a history of central visual blurring coming on within a few days and rapidly increasing will fall into the group known as central chorioretinitis or toxic amblyopia. This condition is rarely if ever caused by tuberculosis or infection in the macular area itself but rather to vascular spasm in the blood vessels supplying the area affected, as pointed out by Duggan (1).

The utmost importance attached to prompt diagnosis and early use of vasodilators can be better appreciated by an understanding

of the underlying pathologic reaction associated with the vascular spasm. This spasm occurs by the contraction of the Rouget cells in the vessel walls, the capillaries being devoid of a true muscular coat. Various factors may precipitate the spasm, the most important of which are toxins, allergy, weather conditions (2), trauma and an abnormally labile vasomotor system (3). It may be local or part of a general picture; transient or prolonged. In any case, it is accomplished by local anoxia and edema, simulating an inflammatory reaction and resulting in a destruction of retinal nerve cells varying in severity with the extent of the spasm and the time over which it persists.

The history and physical findings in these cases are generally as follows. The patient will complain of sudden onset of central vision blurring. There will usually be no ocular pain and the eye will appear normal externally. Of great diagnostic importance is the early inability to see the blue color of a small test object, 5 mm. or smaller, that is, a central scotoma for blue, and a small white test object is seen centrally until macular degeneration occurs; then it too is lost. The fundus may show some macular edema in the early stages but usually appears normal ophthalmoscopically. Later on macular pigmentary degenerative changes occur. Treatment is generally ineffective by that time.

Treatment in these cases must obviously consist primarily in relieving the vascular spasm and consequently the anoxia and edema. The success of the treatment depends upon the rapidity with which this is accomplished, and the only means of so doing is by vasodilators. Treatment on any other basis is doomed to failure because success is gaged in terms of the amount of vision restored.

Various vasodilators are available for use in these cases, sodium nitrate (4) (5) (6) and papaverine hydrochloride (3) being the most successful. Sodium nitrate intravenously has been used by the author in these cases for nearly 6 years with very good results and with no complications. It is obtained commercially as Nitro-scleran, in 1-cc. ampules containing 0.1 gm. of the drug. In treatment one ampule is given intravenously daily for 5 days. Most patients show dramatic visual improvement in from 3 to 5 days, but if no improvement occurs by that time none can be expected. Some patients require up to 5 injections for maximum recovery, but 8 is the average. Care is taken to search for and eliminate any foci of infection, particularly root infections of the teeth or devitalized teeth. Frequently no focus can be found. However at least 8 intramuscular injections of vitamin B₁ (15,000 units) twice a week will help combat toxins from infective foci. Frequent

vision and visual field checks during treatment give the only reliable information of progress. All of these patients were treated on an ambulatory basis in the clinic, carrying on their usual duties during treatment. Since no harm can come from giving Nitroscleran, this treatment should never be delayed until detailed and prolonged examinations regarding the inciting factor are made.

The following representative cases were taken from each group. The first are those patients appearing too late for treatment with vasodilators; macular degeneration had already occurred and the central vision had been lost. Each of these patients received three daily injections of Nitroscleran without improvement in vision.

CASE REPORTS

Case 1.—This patient was seen in June 1944. In May 1943 he noticed some blurring of his central vision O.D. Within 3 weeks the blurring had increased to such an extent that the central vision O.D. was completely gone. He was evacuated to a base hospital where several devitalized or infected teeth were removed. From that time until hospitalization no other treatment has been given and the central vision O.D. is lost. Examination showed vision O.D. 1/20 (eccentric) not improved, O.S. 15/20 with minus .37 \times 90 20/20. There was an absolute central scotoma O.D. extending 10 degrees about fixation. The right macular area showed a moderately large area of granular pigmentary degeneration. There were no signs of activity, this being evidently a healed lesion.

Case 2.—This patient was seen 26 August 1944. About 20 March 1944 he began noticing a blind area centrally before the left eye. There may have been some blurring before this, but he was uncertain of the details. Treatment consisted in artificial fever therapy, after which his tonsils were removed. There was no visual improvement. On examination here at this hospital the vision was O.D. 4/200 (eccentric), O.S. 15/20 with minus .37 minus .37 \times 180 20/20. The visual field showed a large absolute central scotoma O.S. extending irregularly about the fixation point. The right fundus revealed a large area of pigmentary macular degeneration without elevation. There were heavy pigmentary deposits centrally with lighter deposits peripherally and grayish areas between, but there were no signs of activity.

Case 3.—This patient was seen 9 October 1944. During July 1944 the vision O.S. became blurred centrally. The patient believed that the visual loss occurred over a period of several weeks. Treatment consisted of typhoid injections. No focus of infection could be found. On examination the vision was O.D. equalled 20/20, O.S. 3/20 not improved. There was a central scotoma for the 5-mm. blue and also for the 1-mm. white test object, that extended 5 degrees about fixation. Larger white test objects were very faintly seen in this area. Fundus examination showed a small area of macular pigmentary degeneration without elevation, with a small surrounding halo of fine retinal pigmentation. There were no signs of activity.

Case 4.—This man was seen 2 December 1944 presenting the history of a sudden onset of central visual blurring O.D. in April which became complete central visual blindness within a few weeks. By that time treatment was con-

sidered to be useless and none was given. At present his vision is O.D. 6/200 (eccentric), O.S. 20/15 and there is an absolute central scotoma extending nearly 10 degrees about fixation. The macular area O.D. presents pigmentary degeneration without signs of present activity. It is now a permanent lesion.

The second group consists of those patients who were seen shortly after the onset of visual blurring and in whom vision was restored.

Case 5.—This patient was seen 19 April 1944. The vision in the left eye had decreased progressively during the previous week. This man was an aviator and his vision had always been good. On examination the vision O.D. equaled 20/20, O.S. equaled 8/20 not improved. There was a small para-central and central scotoma for the 5-mm. blue test object O.S., with the 2.5-mm. white object faintly seen in this area. Fundus examination revealed some retinal edema bordering on the nasal side of the left macula. There was no measurable elevation or noticeable waviness of the macular vessels and no pigmentation. X-ray films of teeth and sinuses and complete physical examination failed to show a focus of infection. Laboratory tests were normal for blood and urine. He received a total of eight intravenous injections of Nitroscleran given once daily in doses of 0.1 mg., and 1 cc. vitamin B₁ intramuscularly every 3 days for a total of 15 injections. By the fourth day of treatment the vision was 19/20 and the scotoma had largely disappeared. By the seventh day vision was 20/20 and the scotoma no longer existed. The fundus was negative. To date there is no recurrence and vision remains normal.

Case 6.—This man was seen 18 May 1944. The vision became blurred O.S. about 4 days previously and there was some pain behind the eye. The pain had gone at the time of examination but the visual blurring remained. The vision O.S. previously was recorded as 20/20. On examination the vision O.D. equaled 20/20, O.S. 10/20 not improved. There was a central scotoma for the 5-mm. blue test object extending 10 degrees about fixation, with the 5-mm. white test object being blurred in this area. There was some macular edema O.S. without measurable elevation or pigmentation. The edema manifested itself by a halo about the macula. Dental x-ray films were without findings. Sinus x-ray views showed some clouding in all sinuses but especially the maxillary. There was also apparent nasal congestion, but otherwise the nose and throat examination showed negative results. The patient received 12 daily intravenous injections of Nitroscleran and 8 intramuscular injections of vitamin B₁ as well as nose packing and neosynephrin nose sprays. Vision began to improve (13/20) by the third day, was 16/20 by the tenth, and 20/20 by the twelfth day. At this time the central scotoma for blue was gone and the fundus was normal.

Case 7.—This man was first seen 25 May 1944. The case is unique in that visual blurring occurred in both eyes of the patient and it emphasized the importance of the time interval between the onset of blurring and the beginning of treatment in respect to final visual results. Blurring in the right eye began 4 weeks previously and had gradually become worse, while that in the left eye began during the week before admission and was progressively growing worse. Vision had previously been normal in both eyes. On examination the vision O.D. equaled 7/20; O.S. 18/20 not improved with

glasses. There was a large central scotoma O.D. for 5-mm. blue test object and partial for the 3-mm. white test object. The field O.S. showed a small paracentral scotoma for 3-mm. blue test object with some decrease in the 1-mm. white test object. The fundus O.D. showed slight edema in the macula without pigmentation; the fundus O.S. was normal. Complete physical examination including dental and sinus x-ray views failed to reveal a focus of infection. Treatment with daily injections of intravenous Nitroscleran and intramuscular vitamin B₁ was begun immediately. At the end of 6 days' treatment the vision O.D. equaled 14/20; O.S. 20/20. The scotoma O.D. was normal for 1-mm. white test object, but there was a paracentral scotoma for 3-mm. blue on the upper border of fixation. The field O.S. was normal. After 6 more days of treatment the vision O.D. equaled 16/20, O.S. equaled 20/20, and the paracentral scotoma O.S. persisted. The macular area O.D. was slightly darker than normal. Further treatment was considered useless as permanent macular degeneration O.D. was undoubtedly present.

Case 8.—This man was seen on 1 February 1944. Blurring vision O.D. started about a week before, becoming much worse. On examination the vision O.D. equaled 9/20; O.S. 20/20. There was a large central scotoma O.D. for 5-mm. blue and 2-mm. white test objects extending nearly to the periphery laterally. There were moderately heavy vitreous opacities, especially heavy upward and nasally, and retinal edema including the right macular area was present. Old healed areas of retinal degeneration extended upward and nasally nearly to the ora serrata. Treatment with intravenous Nitroscleran and intramuscular vitamin B₁ was begun immediately. After 6 days the vision O.D. equaled 14/20 and the active lesions were smaller. After 12 injections of Nitroscleran the vision O.D. equaled 20/20. There were no longer any active retinal lesions and the central scotoma O.D. was gone. The old healed retinal lesions were unchanged.

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EMERGENCY BLOOD TRANSFUSIONS ON HOSPITAL SHIPS IN WAR ZONES

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Because the clinical pathologic laboratory is responsible for the blood bank aboard this ship, the transfusions are given by the pathologist and his assistants. The entire laboratory staff is trained for this work. Two men perform the bleedings; one does the typing and crossmatching; another is responsible for the cleaning of bottles, tubing, and for assembling the apparatus; and another does the counts and hematocrit readings in order to assure uniform blood examinations. The setup represents what is known as a "blood bank-shock team." The pathologist divides his time between the laboratory and the wards receiving shock or hemorrhage patients; therefore he knows at once whenever a seriously wounded person is brought aboard. He also has authority immediately to start a transfusion if he thinks it necessary, and it is his duty constantly to keep in touch with the patient in shock as long as necessary.

In addition to administering the blood, the pathologist and his staff instruct hospital corpsmen and nurses in the technic used for transfusion. During surgical operations, blood in needed quantity is made available for immediate use and an assistant stands by to introduce the needle and start the flow of blood whenever the surgeon requests it.

The general plan as organized, works quickly and efficiently. On several occasions, in wards and operating rooms, a transfusion has been started within from 15 to 18 minutes after it was requested. Grouped universal type O blood has never been given without a modified crossmatch, as this is considered a very important margin of the "safety zone" which avoids the serious results following the use of mistyped and mismatched blood.

Group O and group A donors have furnished this ship with 85 percent of the grouped blood which has been required.

Donor and method of bleeding.—Blood donors are obtained from members of the crew, from crew members of ships anchored nearby, and often from selected donors at shore stations. Frequently patients who are in good physical health and suffering only from minor injuries offer blood.

A complete listing is kept of the crew and their respective blood types. Men without history of syphilis, malaria, filariasis, or skin diseases, who have normal erythrocyte counts and hemoglobin percentages, receive blood Kahn tests. They are instructed in detail regarding blood-donation procedure, and are told that they will not suffer harm from bleeding and that they will be used only when necessary.

Whenever the ship approaches a battle area, from 20 to 40 bottles of blood are collected. This amount represents the primary "blood-bank stock," and is stored in an ordinary mechanical kitchen refrigerator at 10° centigrade. At this temperature the blood will remain useful for at least 20 days. When blood is stored at 4° C. or lower, hemolysis is apt to occur after it is removed from refrigeration.

Considerable attention is given to the amount of blood withdrawn. Noticeable difference in effect upon the donor, both physiologic and psychologic, can be seen between the withdrawal of 400 and 500 cc. of blood. Frequently 500 cc. when removed, will cause a distinct weakness, and at times even fainting. On the other hand these harmful effects do not occur after taking 400 cubic centimeters.

The donor is placed upon a comfortable, hard-surfaced, padded table. The arm having the best available vein is cleaned thoroughly with a solution of iodine and alcohol. A tourniquet is applied at a point midway on the upper arm, with sufficient pressure to suppress venous return; 0.2 cc. of 1-percent procaine hydrochloride solution is injected intracutaneously over the selected vein; and venipuncture through the anesthetized area with a 15-gage needle is done; the blood flows into the citrated bottle which is constantly rotated to insure complete admixture of blood and citrate and prevent coagulation.

When the bleeding is finished, the donor is given a glass of fruit juice, soft drink, or ice cream. Rarely indeed does bleeding leave the donor with any feeling of weakness, dizziness, or fatigue.

Vacuum jars or bulb suction for acceleration of blood flow are avoided. Using 3 technicians, 3 donors can be bled every 8 minutes. The collected blood is labeled by name, number, type, date. This information is recorded in the blood-bank log which serves as a permanent record. A tube of blood is also attached to each bottle for matching, typing, and for Kahn test rechecks when necessary.

Indications and contraindications for transfusion.—Most patients who have suffered gunshot wounds have lost blood, either externally or internally, and with experience the doctor in the battle zone quickly develops a clinical aptitude which enables him

to select, almost at a glance, those patients suffering from hemorrhage and shock. So apparent does the clinical syndrome become, that at times one feels it almost criminal neglect to await the erythrocyte and hematocrit report. Attention is focused upon the patient whose symptoms are pronounced, or whose injuries are extensive, and blood transfusions are given as quickly as possible, using clinical judgment regarding the quantity required to produce favorable results.

At a later period the injured are studied with the aid of the red blood cell count and hematocrit reading. Patients who have a red blood cell count of 3,000,000 or less are given transfusions; usually two 400-cc. units are injected. However as much as 2,400 cc. has been given but never more than 800 cc. at one time unless absolutely necessary. As a rule surgical patients are given blood during serious operation, because of its effect against shock, particularly during amputations, craniotomies, and abdominal explorations.

Blood transfusion to the burn patient is most often given after the total protein level has been reestablished. It is important that this be repeated to secure an adequate cell volume and to prevent or combat hemolytic anemias which later may develop.

Contraindications for blood transfusions are few. It appears unwise to give patients suffering with hemothorax large quantities of blood; in such instances better results seem to follow if several smaller transfusions (200 cc.) are given. The same rule applies for other bleeding cavities, although it was surprising what amazingly beneficial results were obtained when blood had been given to several patients with severely injured brains.

It is believed that transfusion therapy can be overdone, particularly the so-called "tonic" transfusion. Repeated transfusions have been incriminated as causing extensive capillary bleeding of a very grave type; accumulation of faulty sodium citrate in the tissues might have something to do with this peculiar phenomenon.

Case report.—During the past 5 months one patient aboard died with complicating acute pulmonary edema. This man had a gunshot wound of the left thigh. His femoral vein was severed and he had suffered extensive hemorrhages. He was received aboard ship 4 days after he had been shot. At the time of admission he was pale, stuporous, had a very rapid pulse rate and sighing respirations. He had a blood pressure of 140/80 and his erythrocyte count was 1,900,000 despite 3 transfusions given aboard another ship. He was given 2 units of plasma, followed by 800 cc. of whole blood. Two and one-half hours later his pulse rate became accelerated, edema of the lungs occurred, and death ensued.

Autopsy revealed an extensive pulmonary edema, and severe secondary anemia of all tissues, especially the brain, heart, liver, and spleen. He had a massive acute bilateral pneumonia. His urine contained 300 mg. percent of albumin. His wounds were uninfected,

Pulmonary edema will occasionally follow intravenous medication, especially in patients who have heart, lung, and kidney diseases. It is probable that this patient's edema might possibly be explained by the fact that he had already reached a blood crisis from extensive hemorrhage and cell loss, and there had occurred a disproportion of erythrocytes and cellular fluids, which, with the added effects of the anemia, and the pneumonia, did probably alter the alveolar capillaries. This man might possibly have fared better if the plasma had been omitted and only small transfusions of blood or whole blood cells had been given.

Blood typing and crossmatching.—For typing and crossmatching, 3 concave slides are used, 2 for typing the patient and donor, and the other for the crossmatch. It is believed that much time can be saved by setting up the left (minor) side of the crossmatch (donor's serum versus patient's cells) immediately, before typing either patient or donor. This is done on assumption that both parties are of the correct blood group as stated.

The donor's cell suspension is then made, and both bloods are placed in the centrifuge in the usual manner. After the blood tubes are removed from the centrifuge, the right (major) side of the crossmatch (donor's cells versus patient's serum) is set up. Cells and serum are thoroughly mixed, and all slides are repeatedly checked. If the types of both donor and recipient are as originally given, much time is saved with a compatible crossmatch; if not, a second crossmatch may be quickly accomplished. The standard time allowed for the final crossmatch reading is 20 minutes after completing the setup.

The quickest time in which a crossmatch has been completed has been 15 minutes. In 580 instances there has been only one detected error in crossmatching.

Transfusion reactions.—The cause of transfusion reaction cannot be fully explained, but through experience the following causes are believed of primary importance: (1) Over-used rubber tubing; (2) improper methods of cleaning tubing and glassware (pyrogens); (3) incorrect blood matchings; (4) repeated transfusions.

Treatment of patients who complain of a chilly sensation or who show objective symptoms of chill following a transfusion consists of giving 1 ounce of whiskey and a 5-grain aspirin tablet and covering with a warm blanket.

Occasionally susceptible patients were given ephedrine sulfate by hypodermic, as a preventive, 20 minutes before the transfusion. In other instances morphine, $\frac{1}{8}$ grain, or codeine, $\frac{1}{2}$ grain, and sometimes aspirin, 10 grains, was beneficial in preventing a reaction or in lessening its severity.

Although it is difficult accurately to assay transfusion reactions, a review of 580 transfusions showed 3.7-percent reaction, paralleling the report of 3.6 percent in the extensive series done by the Subcommittee on Blood Substitutes of the National Research Council.

A word of caution might be added concerning reactions from incompatible blood. Such reactions usually manifest themselves after from 25 to 100 cc. has been given. As soon as symptoms occur, the transfusion must be immediately stopped. Fear, apprehension, nervousness, pain in the back and head, and chest oppression are the ordinary symptoms, later followed by profuse sweating.

Cleaning of equipment.—The two packs necessary for obtaining and giving blood are the donor tubes and the intravenous sets. Donor tube pack includes: (1) A donor tube 15 inches long; (2) a needle, 15-gage, Yale Rustless B-D, attached to one end of the donor tube, protected by inserting into a cotton-stoppered 13- by 100-mm. test tube; (3) a glass adapter attached to the other end of the donor tube (when in use this adapter is inserted into the hole in the stopper on the parenteral bottle); (4) six tubes wrapped in a 24- by 24-inch field cloth, with folds separating each tube.

The intravenous pack, wrapped in a 24- by 24-inch field cloth, contains: (1) A plain arm splint, $3\frac{1}{2}$ inches wide by 18 inches long; (2) two 4- by 4-inch gauze pads protecting two 18-gage needles; (3) an air vent (a short length of rubber tubing connected to a piece of glass tubing 4 inches long and 4 mm. in diameter, bent at right angles) and a filter, rubber tubing, needle adapter, and clamp (these are assembled before packing as a unit).

Both donor and intravenous packs are sterilized in the autoclave at 15 pounds' pressure for 15 minutes.

Both intravenous and donor sets are cleaned in the following manner: All rubber tubing, filters, and needle adapters are washed thoroughly, disassembled, and inspected for adherent blood at any point of connection. In a hand basin 5-percent sodium carbonate solution is forced through the tubing under suction; all tubing is coiled and heated in the autoclave or on a hot plate for 15 or 20 minutes. It is rinsed thoroughly with tap water under suction and washed with pyrogen-free distilled water. (Distilled water should not be over 4 hours old.) The equipment is made ready for assorting in packs after washing in 0.85-percent sodium chloride (CP) solution.

The blood bottles and rubber stoppers, after use, are rinsed thoroughly with tap water and soaked in a "slick" solution of

trisodium phosphate at least $\frac{1}{2}$ to 1 hour. They are then rinsed thoroughly with tap water, then distilled water, and finally with 0.85-percent saline solution. After rinsing with saline solution, the bottles are "citrate" with the addition of 50 cc. of sodium citrate, 2.5-percent (W/V) U.S.P., stoppered and secured with screw cap. A 4- by 4-inch gauze pad is placed over the stopper and covered with a piece of wax paper. The whole is secured by a piece of white string wrapped around the bottle's neck and the pack sterilized in the autoclave at 15 pounds' pressure for 15 minutes.

A board placed under the bottles during sterilization will prevent breakage, and after sterilization the pressure in the autoclave should be reduced very slowly. Occasionally if the bottles are unused for 2 weeks or more, a precipitate will form in the citrate solution. The contents of such bottles are discarded and new solutions are placed in them.

Administration of blood.—The original parenteral bottle has been somewhat modified for ship use. The vent has been removed and a 4-mm. glass tube, 12 cm. long, bent into the shape of an "L" and attached to a rubber tube the length of the bottle, is used as an air vent. The glass tube is inserted into the hole in the cap at the time of transfusion. The filter, tubing, and needle assembly is inserted into the remaining hole; and the tubing is ready to be filled.

Shaking of the bottle is an important procedure. The bottle is held in a horizontal position and shaken vigorously 2 or 3 times in the same plane, facilitating the immediate flow of the blood into the filter tube. At the bedside, the entire transfusion set can be assembled in less than $\frac{1}{2}$ minute.

CONCLUSION

A method has been presented for giving transfusions to patients in battle areas. It is simple, safe, economical, and speedy. The apparatus is easily cleaned and arranged. It can be transported, or assembled later at the bedside in less than $\frac{1}{2}$ minute. The donor's blood can be withdrawn in 4 minutes and can be successfully stored and kept in an ordinary refrigerator for at least 20 days.

The crossmatching of the blood in an emergency can be properly carried out by trained technicians in from 12 to 18 minutes, and the blood can be given at any rate of speed desired, ranging from 72 to 200 drops per minute; and if the occasion demands, it can be allowed to enter the vein in a steady flow. As many as from 6 to 10 transfusions can be given simultaneously to different pa-

tients; on one occasion 9,200 cc. of blood was given in 23 transfusions between the hours 1530 and 1930.

The number of reactions has been low and of very little importance. In fact on one trip 156 transfusions were given without the occurrence of a single reaction.

ACKNOWLEDGMENT.—Appreciation is extended to W. S. Wardlaw, Chief Pharmacist's Mate; J. C. Schwarting, Pharmacist's Mate, second class; P. R. Vogan, Pharmacist's Mate, second class; J. A. Fisher, Pharmacist's Mate, second class; and Oscar Riley, Pharmacist's Mate, second class, all of the Naval Reserve, for their cooperation and assistance in the work described in this article.



PERIARTERITIS NODOSA FROM THIOUREA

Various undesirable effects of thiourea and thiouracil have been described. Leukopenia and granulocytopenia are the most common complications, but rashes, hyperthermia and jaundice have also been noted. A 46-year-old woman died following therapeutic doses of thiourea for approximately 6 weeks. At autopsy the pathologic condition was identical with periarteritis nodosa. It is interesting to consider its relationship to the thiourea therapy. The toxic action of this drug seems usually to be restricted to the leukopoietic tissues and the liver, sometimes producing agranulocytosis or jaundice, but the full range of its toxicity has probably not yet been revealed.—GIBSON, P. C., and QUINLAN, J. T.: Periarteritis nodosa from thiourea. *Lancet* 2: 108-110, July 28, 1945.



ESTROGENS' EFFECT ON BLOOD CHEMISTRY

Injection of estradiol dipropionate into immature chicks results in large increases in serum calcium, cholesterol, inorganic phosphorus, lipid phosphorus and protein phosphorus (serum vitellin). Administration of thyroxin prevents the rise of serum cholesterol. The changes in serum cholesterol are not accompanied by changes in the total cholesterol content of the body and therefore are not due to changes in synthesis or destruction of cholesterol but alterations in the distribution between plasma and tissues. Estradiol causes mobilization of cholesterol into the plasma while thyroxin causes the cholesterol to be retained in the tissues.—FLEISCHMANN, W., and FRIED, I. A.: Studies on mechanism of hypercholesterolemia and hypercalcemia induced by estrogen in immature chicks. *Endocrinology* 36: 406-415, June 1945.

CLINICAL NOTES

SIMPLE ISOLATED DISLOCATION OF THE FIFTH METACARPO-HAMATE ARTICULATION

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A simple isolated dislocation of the base of the fifth metacarpal joint is so rare an injury as to merit recording. A thorough search of the literature indicates only 9 such cases previously reported. Some standard textbooks on fractures do not even mention the possibility of its occurrence.

Case report.—A 37-year-old sailor fell on his extended left arm, the force of the fall being concentrated on the ulnar border of the hand. He immediately felt pain in the hand and little finger, and noticed on arising that the little finger “stuck out at an angle away from the other finger.” He pulled on the little finger and at the same time pushed it toward the fourth finger while maintaining traction. He felt something “give” in the hand, the pain decreased greatly, and the finger position was improved.

At examination 30 minutes later there was slight shortening of the little finger, a tendency for it to spread away from the fourth finger, and tenderness around the base of the fifth metacarpal. X-ray examination showed a dislocation of the fifth metacarpal at its base (fig. 1).

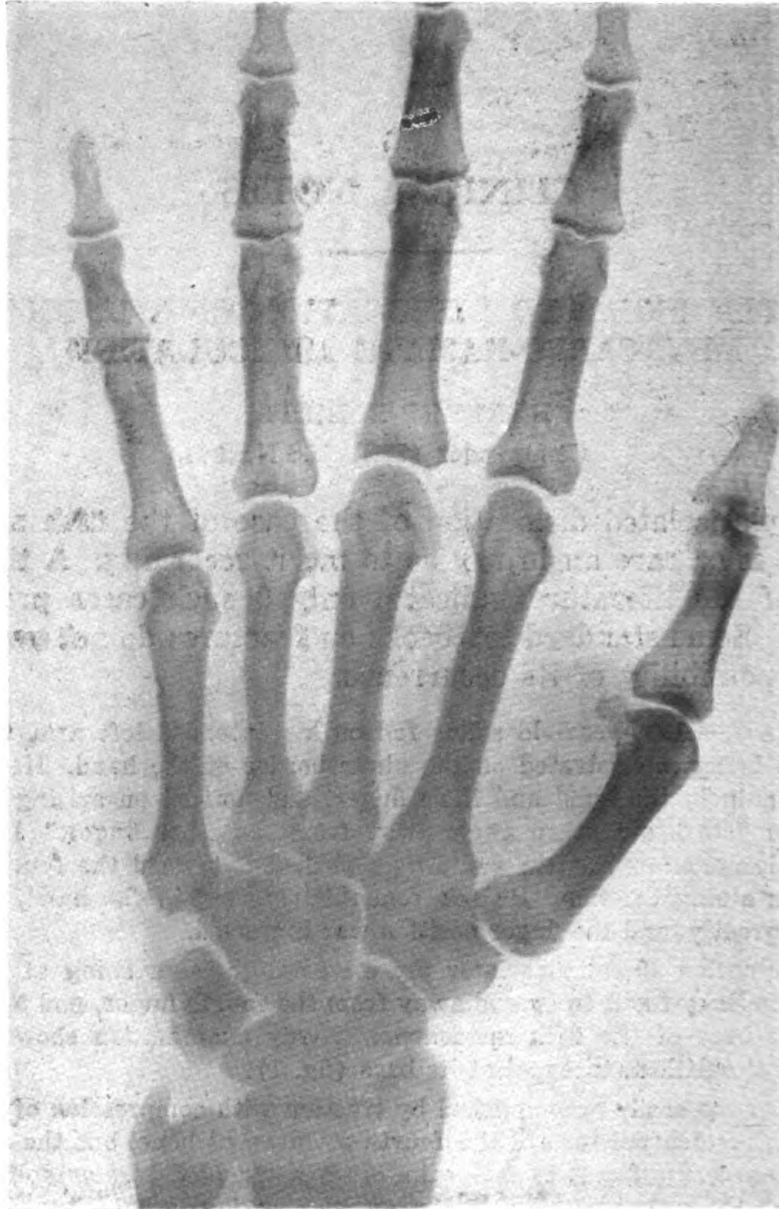
Reduction was easily accomplished by traction with compression of the base of the fifth metacarpal toward the fourth metacarpal bone, but the corrected position was very difficult to maintain. Two nonpadded plaster splints were applied so as to maintain a constant pressure over the base of the fifth metacarpal, holding the hand in slight radial deviation. This maintained the position satisfactorily.

These splints were removed after 5 weeks. There was immediate normal function of the hand and fingers, and an x-ray examination showed normal position of the joint.

Subsequent roentgenographs made 1 week later and again 6 months later showed a retention of the normal position. Hand and finger function was normal despite active use of the hand.

COMMENT

The injury occurs by traumatic force directed against the palmar and ulnar border of the hand, usually as a result of a fall. Two types of simple isolated dislocation have been reported,

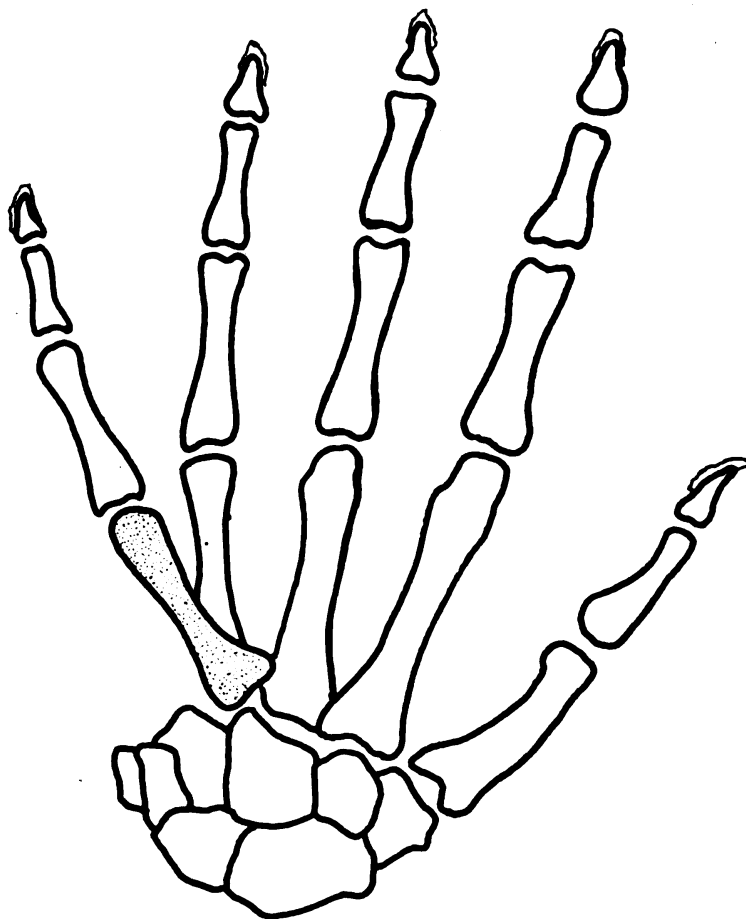


1. Dorsal and ulnar type of dislocation.

namely, (1) the dorsal and ulnar type, and (2) the palmar and radial type.

The dorsal and ulnar dislocation is the type presented here. The base of the fifth metacarpal lies separated from the base of the fourth metacarpal and off the articular surface of the hamate bone. It also is pulled slightly dorsally and proximally by the extensor carpi ulnaris, which inserts on the ulnar border of this metacarpal.

In the second type the base of the fifth metacarpal is dislocated radially and palmarly and lies in the space between the flexor tendons and the other metacarpal bones (fig. 2).



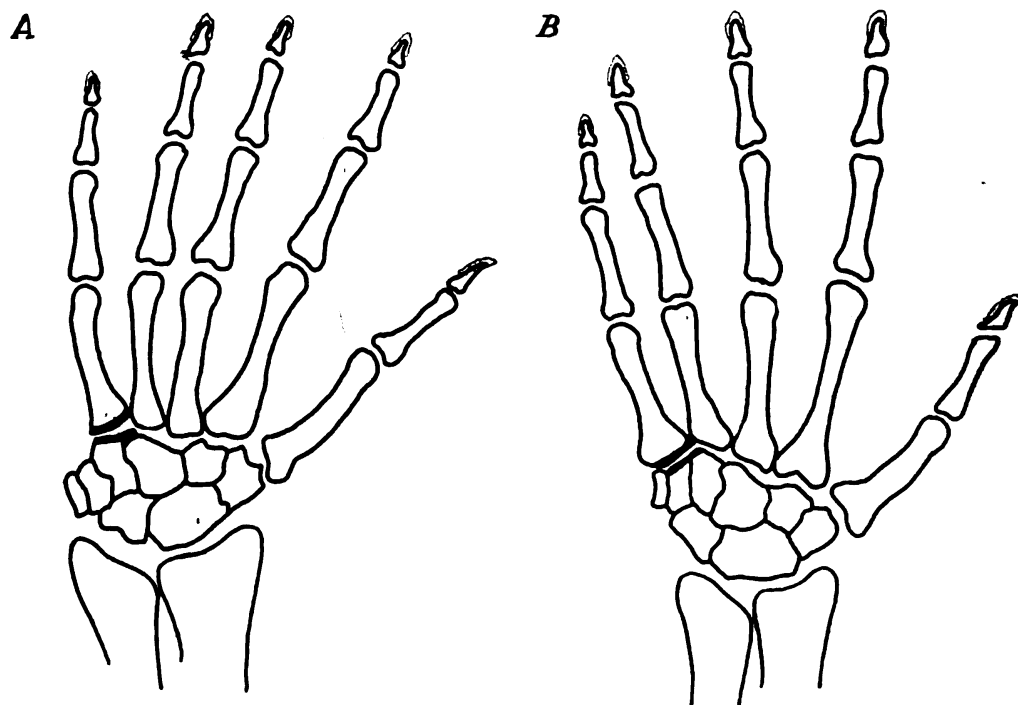
2. Palmar and radial type of dislocation from a reported case.

Murless (1) pointed out the presence of a tiny chip fracture of the base of the fifth metacarpal that remained attached to the hamate bone. He found that it would be visualized on the anteroposterior view only when the hand was held in a position of supination.

All x-ray reproductions in the reported cases were reviewed, and in the cases of Murless (1), Buzby (2), and Watson-Jones (3) these tiny fractures were seen. It is possible that they may have been present in the others but did not show because of the anteroposterior exposure having been made with the arm in pronation. Such a fracture was not present in the case presented here.

However in any case the predominant lesion is the dislocation, and the presence of the chip fracture is more of academic interest than of practical importance.

Treatment.—In the dorsal and ulnar type, reduction is easy, but some degree of compression must be constantly maintained



3. A. Wrist in radial deviation. B. Wrist in neutral position. The fifth metacarpal-hamate joint is more nearly transverse to the pull of the extensor carpi ulnaris if the wrist is in radial deviation and thus more stable.

until healing is complete (fig. 3).

All four of the reported dorsal and ulnar dislocations were treated by closed reduction. In two patients maintenance of reduction was completely unsuccessful and in a third case only partly so, as the bone was found to have slipped partially out of place at the end of the third week. The treatment in each case was constant traction. Cotton (4) reported success with his case treated by closed reduction and traction. His report is, however, very meager and presents too little data for an accurate appraisal of the case.

Constant traction definitely was not successful in maintaining reduction in the case herein reported. The shortening was corrected, but the base of the fifth metacarpal would not move against or remain against the base of the fourth metacarpal where it belonged. Constant pressure directed radially against this metacarpal base was necessary to maintain a normal position, and when this was done traction became unnecessary. It was also noted that reduction could be more securely maintained if the hand was deviated radially on the wrist. Figure 3 shows the reason for this.

It seems likely, then, that the most successful treatment for this

dorsal and ulnar type of dislocation, step by step, is:

1. Application of traction to the little finger.
2. Radial compression against the base of the fifth metacarpal.
3. Release of traction on the little finger.
4. Immediate application of smooth, nonpadded plaster splints, holding the hand in slight radial deviation and making radially directed compression over the base of the fifth metacarpal.
5. Retention of splints in position for 5 or 6 weeks.

Active but careful use of all the fingers may be allowed.

The palmar and radial type of dislocation can be reduced without an open operation if the patient is seen early after the injury. Murless reported such a case. It is also possible that the patient who is reported here at first had this type, as he estimated the angulation between the fourth and fifth fingers as being about 35 or 40 degrees. He pulled on the finger himself, and probably by doing this reduced the palmar and radial dislocation, leaving it in the residual dorsal and ulnar position as it was found in the x-ray picture.

Any simple isolated dislocation of the base of the fifth metacarpal when reduced, unless it is held securely in place, will immediately change to a dorsal and ulnar type because of the pull of the extensor carpi ulnaris. A brief study of the anatomy of these structures will show why this is true. Hence after reduction, proper position must be maintained in the manner described for the dorsal and ulnar type. That compression is necessary was also emphasized by Murless, who used a felt pad and an elasto-

Comparison of reported cases

Author	Type of treatment	Type of dislocation	When first seen	End result	Remarks
Busby.....	Open reduction	Palmar and radial	2½ wks. after injury	Good	Very meager report.
Cotton.....	Closed reduction and traction	Dorsal and ulnar?	?	Good?	
Roberts and Holland	Closed reduction and traction	Dorsal and ulnar	Immediate examination; roentgenograph 5 days later	Fair	Closed reduction failed. No further treatment. Result reported at end of 5 months.
Roberts and Holland	Closed reduction and traction	Dorsal and ulnar	Immediate examination and roentgenograph	Fair	Closed reduction failed. No further treatment. Result reported at end of 30 months.
Roberts and Holland	Closed reduction and traction	Dorsal and ulnar	Immediate examination and roentgenograph	Fair	Reduction partially lost after 3 weeks' traction. No further treatment.
Roberts and Holland	?	Palmar and radial	?	?	No data available except that patient was an adult male.
Murless.....	Closed reduction	Palmar and radial	Immediate examination and roentgenograph	Good	Reduction maintained with felt pad, elastoplast dressing and cast.
McWhorter..	Open reduction	Palmar and radial	2 wks. after injury	Good	Closed reduction failed; then open operation done.
Watson-Jones	Open reduction	Palmar and radial	7 wks. after injury	Good	

plast bandage to secure the necessary radially directed compression force against the base of the fifth metacarpal.

In old cases in which open reduction is necessary, a fusion of the metacarpo-hamate and intermetacarpal joints (base of the fourth and fifth) is probably the procedure of choice, as it has given good results in the reported cases.

Prognosis.—All authors have reported fair and good results. In three cases reduction was not successful, yet the author emphasized in each case that the hand and finger function was fairly good.

In old cases where open operative reduction is necessary, the prognosis remains excellent, as evidenced by the cases of Watson-Jones, McWhorter, and Buzby.

CONCLUSIONS

1. An isolated dislocation of the fifth metacarpal at its base is a very unusual injury.
2. When seen early, closed reduction is not difficult.
3. Maintenance of reduction is difficult. Continuous compression radially directed over the base of the reduced fifth metacarpal, with the hand held in radial deviation, is necessary to maintain securely the reduced position.
4. Excellent function may be expected following successful reduction and fixation for 5 or 6 weeks.

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ABSCESS OF PREVERTEBRAL CERVICAL FASCIAL SPACE

AS COMPLICATION OF SCARLET FEVER

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The modern concept of scarlet fever is that it is a local infection of streptococcic origin, most often affecting the mucous membranes of the pharynx, where a specific soluble exotoxin is produced, which is absorbed and gives rise to constitutional manifestations. The causative organisms invade the body and give rise to other localized infections, chiefly in the glands, ears and sinuses, less often in the joints and other locations. The chief pathologic lesion is a hyperplasia of all the lymph structures.

Complications, which are very frequent, fall into two groups: (1) Those thought to be due to the scarlet fever toxin per se, which occur within the first 2 weeks of illness; and (2) those due to infection either by the original streptococcus (though perhaps of another strain) or by secondary invaders, which infections occur after the second week of illness. Among complications which have been reported are cervical adenitis; otitis media (which may develop into mastoiditis); sinusitis, most often involving the ethmoid cells; septic pharyngitis; peritonsillar abscess (quinsy); simple albuminuria; nephritis (glomerular or diffuse); arthritis; septicemia; infectious endocarditis; toxic myocarditis; meningitis, meningismus and other affections of the central nervous system; toxic psychoses; enteritis; acute mesenteric lymphadenitis; and phlebitis, usually involving the veins of the upper extremities.

Pulmonary complications, in contrast to their frequency in certain other exanthematous diseases, are not very common in scarlet fever, but empyema is a fairly frequent sequel when pneumonia does occur. Gangrene of the extremities now seldom occurs in properly treated cases. Such bizarre complications as sloughing of the neck and throat tissues, with perforation of the external jugular vein or rupture of the internal jugular vein, have been reported but are not usual.

Despite the frequency of abscesses in various portions of the

body after scarlet fever, the particular region involved in the case herewith reported, that is, the prevertebral cervical fascial space, was not found mentioned in a representative number of standard textbooks of medicine and in monographs of infectious diseases which were examined. A perusal of the periodical literature of the last 10 years also revealed no similar case, although all possible terminologies were investigated, and all scarlet fever cases reported during this period were read. As with all apparently rare conditions, there is little doubt that other similar instances have occurred, but if so, they seem to have gone unreported. It seems justified therefore to say that abscess of the prevertebral cervical fascial space is a unique complication of scarlet fever.

Case report.—A machinist's mate, 32 years old, was seen on 13 February 1944 complaining of a sore throat which had gradually become worse since onset 48 hours before, and of headache, vomiting, and generalized malaise. He was immediately hospitalized.

Physical examination showed him to be a well-developed, acutely ill young man. The temperature was 102.6° F., the pulse rate 120, and the respirations 28 per minute. A finely granular rash on an erythematous base covered the chest and lower abdomen. The throat was acutely inflamed and edematous, and both tonsils were covered with an exudate. There were hemorrhagic areas on the soft palate. There were no other pertinent physical findings.

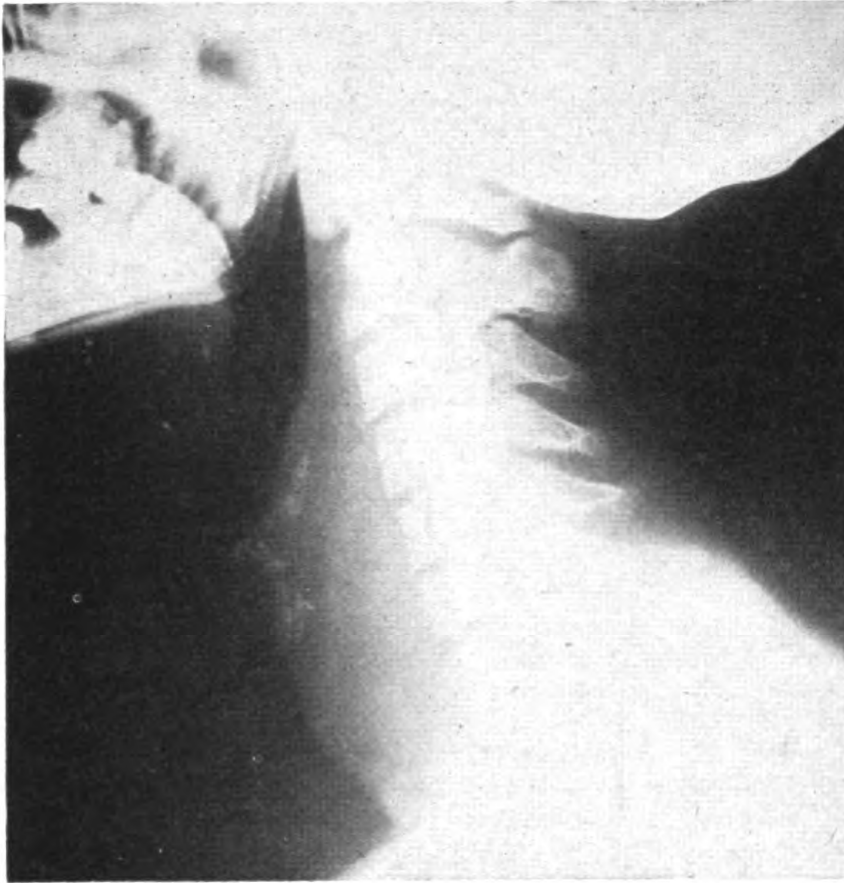
The clinical impression of scarlet fever was confirmed by a positive Schultz-Charlton test. A culture of the exudate from the throat was reported positive for *Streptococcus pyogenes* (Lancefield's serologic group C).

Treatment consisted of hot saline gargles, the administration of salicylates, and symptomatic measures. Scarlet fever antitoxin was not used. The rash disappeared within a few days and the throat appeared normal, but the temperature continued to be elevated to 102° F. daily.

On the sixteenth day of hospitalization the patient complained of dysphagia, which he said had been developing for the past several days, although he had not previously mentioned it or given evidence of it. Forty-eight hours later he complained that he could not swallow at all. Local examination at this time revealed a swelling on the anterior surface of the neck, above and in the region of the thyroid gland.

An otorhinolaryngologist reported that inspection revealed a moderate excess of pharyngeal lymphoid tissue, slight mucopurulent postpharyngeal accumulation of postnasal origin, and moderate pharyngeal hyperemia. No gross abnormality was observed above the larynx, and the vocal cords were normal. The patient's complaint that he could not swallow was confirmed by having him drink water under observation; each time that he attempted to swallow it, it came out through his nose. The otorhinolaryngologist concluded that the dysphagia was on the basis of esophageal obstruction below the level of the larynx.

Roentgenologic examination of the chest did not reveal any abnormality. Examination of the cervical region in the lateral, anteroposterior, and both oblique positions, fluoroscopy with a small barium meal, and repetition of the films after ingestion of the opaque medium revealed the presence of a large fusiform swelling of the soft tissues, originating at the level of the inferior



Lateral view of cervical area showing fusiform swelling of soft tissues, with forward displacement of trachea and esophagus.

margin of the third cervical body and extending downward through the superior opening of the thoracic cage as shown in the accompanying illustration.

The greatest diameter of the swelling was apparently immediately below the laryngeal cartilage, at which point the size of the prevertebral space was increased approximately four times above normal; at the level of the first thoracic body it was increased approximately two and one-half times above normal. The swelling caused a forward displacement of the trachea and the esophagus above the level of the superior thoracic opening. In this area the esophageal lumen, which was outlined by a thin layer of barium administered during the earlier fluoroscopic examination, appeared as a very fine line adjacent to the posterior surface of the trachea. There were no osseous changes in the cervical spine and no evident lesions in the joints or in the intervertebral spaces. The conclusion was that the lesion was a large fusiform prevertebral swelling of the soft tissues, situated above the superior opening of the thorax and resulting in forward displacement of the esophagus, larynx and trachea.

On a diagnosis of abscess of the prevertebral fascial space, operation was performed on 5 March, using local anesthesia by means of 40 cc. of 1-per-cent procaine hydrochloride. An incision, $3\frac{1}{2}$ inches in length, was made along the lateral border of the sternocleidomastoid muscle, beginning at the

sternoclavicular junction. The platysma was cut and the sternocleidomastoid muscle was retracted superiorly and medially. The external jugular vein was ligated and the carotid sheath was exposed and retracted medially. The scalenus anticus muscle was retracted posterolaterally, and the prevertebral fascia was thus completely exposed.

An aspirating needle was inserted into the mass, over which the tissues appeared thickened and edematous, and thick, creamy pus was evacuated. More of the same material escaped when a small incision was made in the area of the needle puncture, and a total of about 5 ounces of pus was evacuated when the incision was enlarged enough to admit a finger. A gauze pack soaked in azochloramid, to which sulfanilamide crystals had been added, was inserted into the bed of the abscess and was brought out of the wound at the most dependent angle. A rubber tissue drain was similarly placed. The wound was closed in layers through which sulfanilamide powder was sprinkled liberally.

Sodium sulfadiazine, which had been administered by the intravenous route since 3 days before operation, was continued for 5 days after operation. The pack and drain were removed on the sixth day, after having been gradually shortened for the preceding 3 days. Recovery was completely uneventful, and the patient was discharged to full duty on 19 March. Inquiry reveals that he has had no sequelae of his illness to the date of writing.

Laboratory studies.—Results of urinalyses had been consistently negative throughout the illness. The initial examination of the blood revealed a moderate secondary anemia (70-percent hemoglobin concentration, with 3,400,000 red blood cells per cu. mm.), and a leukocytosis of 22,100 white blood cells per cubic millimeter. Repetition of the examination on 2 March, when dysphagia first became clearcut, revealed 83 percent hemoglobin, and 4,310,000 erythrocytes and 15,300 leukocytes per cubic millimeter, 63 percent of the leukocytes being segmented polymorphonuclear cells and 20 percent band forms. Blood culture on 4 March was sterile. Pus from the wound was reported as showing *Streptococcus pyogenes*.

COMMENT

It should be emphasized that results of urinalyses were consistently negative during the patient's illness, and there was nothing in the clinical course to suggest renal involvement. That the infection was blood-borne seems a reasonable assumption.

Early recognition and prompt diagnosis and treatment of this complication are important, because of the vital location of the abscess and because of the serious situation that would arise if rupture were to occur into the superior mediastinum, which is anatomically possible.

STERILIZATION AND LUBRICATION OF DENTAL HANDPIECES¹

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A method has been devised and tested at this Naval training center which appears to have eliminated the difficulties, the inconveniences and the excessive time consumed in adequately sterilizing and lubricating dental handpieces. The idea is not a new one, but a combination of various reported technics. The method has improved the functioning ability of handpieces, decreased the over-all maintenance required, and assured a relatively sterile instrument.

Essentially the procedure consists of running the handpiece in a cleansing solution after its use on each patient and then immersing it in a hot oil bath. The handpiece cleaner used is a solution of xylol, carbon tetrachloride and liquid petrolatum, and the sterilizing agent is liquid petrolatum heated in a sterilizer to 300° Fahrenheit. These items are readily obtainable and relatively inexpensive.

METHOD

The handpiece is operated in the cleansing solution for 1 minute to remove grit, mucus and other contaminations. It is then placed in the hot oil bath where it remains for 5 minutes, and upon removal is placed in a suitable container for cooling and draining of excess oil. When cool, a blast of air from the air syringe into the oil holes further eliminates unnecessary oil. The handpiece is then wiped thoroughly with a piece of gauze, dampened with alcohol if required, and placed in the cabinet drawer. The whole procedure requires only a few minutes of the dental assistant's time.

The cleaner is made as follows:

	Cc.
Xylol	200
Carbon tetrachloride	200
Liquid petrolatum	400

The xylol makes the solution much more effective but is not essential. If xylol is not used, the quantity of carbon tetrachloride

¹ Received for publication 16 November 1944.

is doubled, so that the mixture will be 50-percent carbon tetrachloride and 50-percent liquid petrolatum.

Three types of sterilizers were tested for heating the oil. A Pelton-Crane sterilizer, model 214, was selected, as it was found to be the only one that did not automatically turn off before the desired temperature of 300° F. was attained. Another feature of this sterilizer is that it is constructed with an enamelware pan which seems to emit less fumes when the oil is brought to a high heat.

Liquid petrolatum (heavy) is used for the oil immersion. It is poured into the sterilizer to a depth of 1 inch; more can be

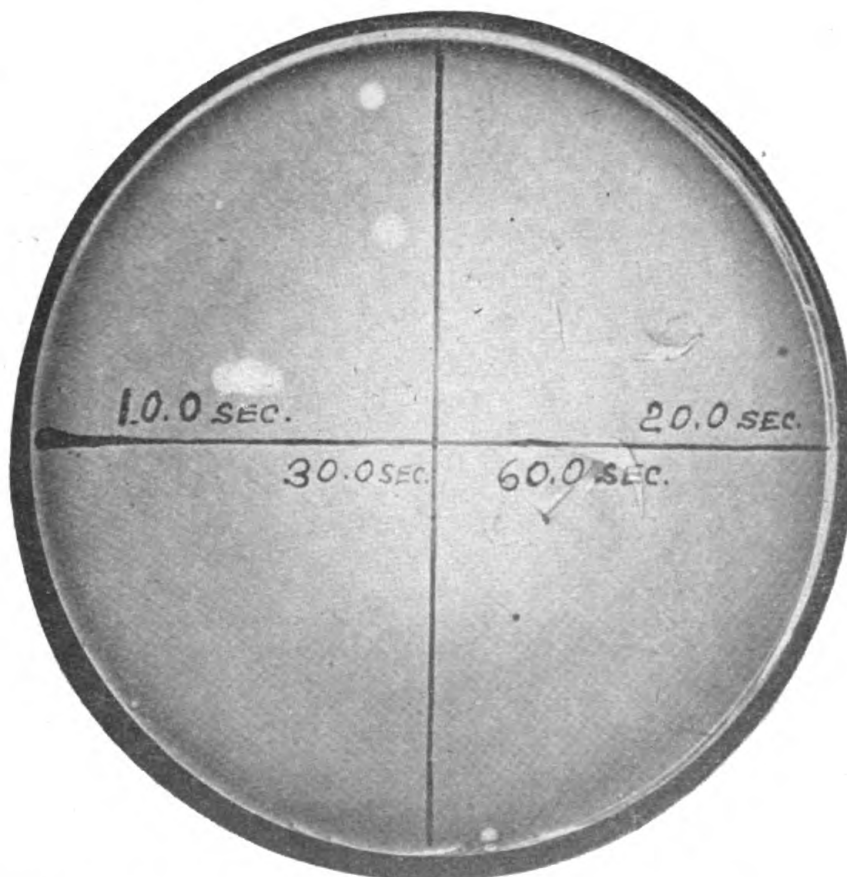


1. Sterilizing efficiency test of a 300°-F. oil bath at 0.5 second, 1 second, 2 seconds, and 5 seconds.

added as required. The oil bath should be changed as often as necessary. It has been found that emptying and refilling the sterilizer twice weekly is essential under heavy, continuous usage. The odor of oil can be eliminated by adding approximately 1 tablespoonful of methyl salicylate to the oil bath. An ordinary baker's thermometer has proved useful in gaging the temperature. The

temperature is more easily regulated by keeping the sterilizer switch on the "low" position. It is never necessary to switch to the "medium" or "high" positions.

It is necessary to have a receptacle in which to place the handpiece for drainage of oil, and for cooling, which will require approximately 10 minutes. If one sterilizer is used for several dental operating rooms, it is advisable to have individual containers for each room. The dental assistant may place the handpiece directly into the container and carry it to his room where it may drain and cool, thereby eliminating an extra trip to the sterilizer. A metal box is preferable, with several layers of gauze



2. Same test, at 10 seconds, 20 seconds, 30 seconds, and 60 seconds. Notice absence of colonies in the 20-, 30- and 60-second quadrants. Tests at 120 and 300 seconds were also growth free.

in the bottom to absorb the drainage. Small wooden or cardboard boxes will also serve the purpose.

Experiments were conducted to test the sterilizing efficiency of a 300°-F. oil bath. *Streptococcus pyogenes*, being a common

pathogen, was used as the test organism (fig. 1). A standard loop was used to collect the test material from a pure culture on a blood agar plate. The oil was brought to a temperature of 300° F., and the loop was immersed in the oil for the given length of time.

<i>Length time loop was immersed (seconds)</i>	<i>Colonies present after 24-hour culture</i>	<i>Length time loop was immersed (seconds)</i>	<i>Colonies present after 24-hour culture</i>
0.5	4	20.0	0
1.0	3	30.0	0
2.0	3	60.0	0
5.0	2	120.0	0
10.0	1	300.0	0

The minimal time required for sterilization is thus seen to be over 10 seconds. Nine handpieces were immersed, one at a time, in a 24-hour tryptose phosphate culture of *Streptococcus pyogenes*. Each handpiece was then immersed in the oil for a given length of time, removed and transferred to a tube of sterile tryptose phosphate broth. The cultures were incubated for 24 hours at 37° C., examined at the end of that period, and then transferred to blood agar plates for further examination. All cultures remained sterile.

In addition to the foregoing tests, 118 cultures were taken from handpieces at random direct from the oil bath in the various dispensaries throughout this training center. All cultures were found to be sterile.

COMMENT

The purpose of this study was to find a suitable method for proper sterilization and lubrication of dental handpieces. Dental handpieces were being damaged faster than replacements could be provided. The methods used to sterilize and lubricate handpieces upon investigation were found to be inadequate. A typical completely disassembled handpiece turned into the dental maintenance shop showed worn gears, accumulations of sediment, rust, and mutilated parts. During a 9-month period, 1,281 such handpieces were turned over to the dental maintenance shop at this training center for replacement of worn gears and miscellaneous parts. In addition to the number repaired, during the same period, 131 handpieces were found no longer serviceable.

In a 5-week period, since use of the method described was inaugurated throughout all dental activities here, there has been a 61-percent drop in the number of handpieces turned in for servicing. The handpieces requiring servicing were those that were already badly worn when the system went into effect.

Hot water sterilization of dental handpieces has not proved satisfactory because it cooks the sediment around the gears, rather than dissolving it. In addition, minerals in the water tend to deposit in and around all parts of the handpiece when this method is used. The sediment acts as an abrasive paste and further prevents oil from adequately lubricating the instrument when applied in the usual manner. Cold sterilization of dental handpieces is not satisfactory because it is a great time consumer, does not remove the sediment, causes rust and corrosion, and is not dependable as a sterilizing agent.

By using the handpiece cleanser, followed by the hot oil bath, a relatively² sterile and properly lubricated instrument is assured, one that will give more efficient service over a longer period of time.

² The term "relatively sterile" is used to denote the lack of destruction of spores. Since boiling water will not destroy spores in 15 or 20 minutes, and we use this method routinely for "sterilizing" instruments, the end result will remain the same for both, namely "relatively sterile."



PSOAS MUSCLE SYNDROME

The more common subjective manifestation of psoas myositis and fibrositis syndrome is unilateral or bilateral dull aching pain in the lower quadrant of the abdomen, which may persist for days, weeks, months, and even years. Exacerbations and remissions with complete disappearance of symptoms are common. Tenderness over the psoas muscle is the only definite objective manifestation. This tenderness is increased when the muscle is contracted or stretched, and as a rule extends from the origin of the muscle along its entire course to the tendon and to its insertion into the femur. Both psoas muscles are frequently involved, but one side is usually the more severe. Trauma, defects in body posture, acute infections, or pregnancy appear to be exciting causes. Sacro-iliac syndrome and fibrositis of other muscles are common accompaniments. The syndrome may be confused with diseases of the appendix, small bowel, colon, urinary tract, uterus, fallopian tubes, ovaries and vertebral column. In 25 of the 50 cases abdominal operations have been performed alone or in conjunction with perineal repair because of mistaken diagnosis.—GREENE, J. A.: Syndrome of psoas myositis and fibrositis; its manifestations and its significance in differential diagnosis of lower abdominal pain. *Ann. Int. Med.* 23: 30-34, July 1945.

TREATMENT OF SALIVARY GLAND OBSTRUCTIONS

REPORT OF TWO CASES

GEORGE W. CHRISTIANSEN

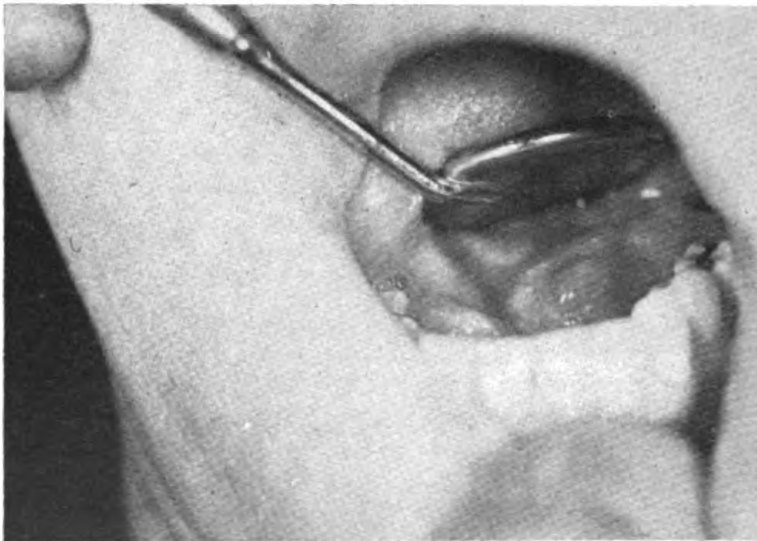
Commander (DC) U.S.N.R.

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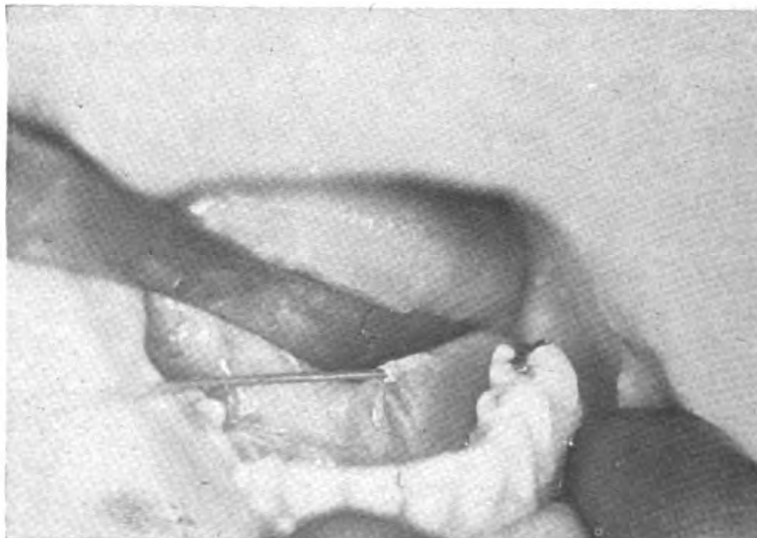
JAMES L. BRADLEY

Commander (DC) U.S.N.

Two cases of chronic periductal adenitis and sialadenitis are reported. They were similar in that each produced local dis-

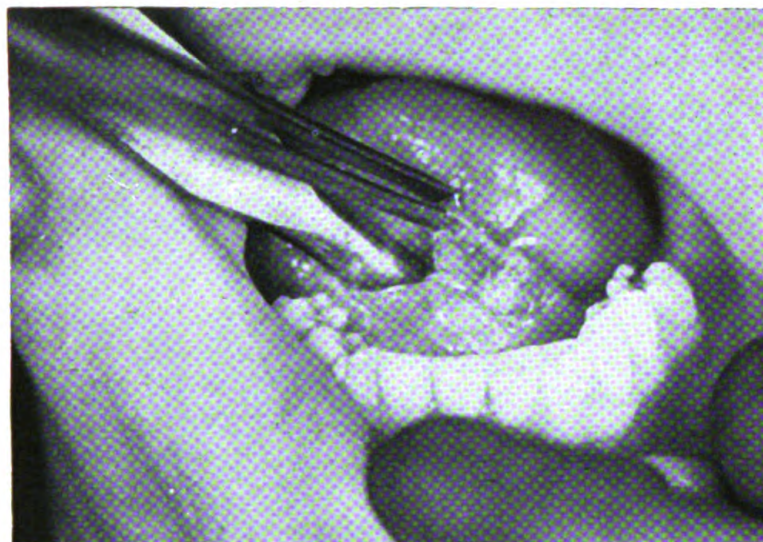


1. Fibrous-like swelling of the left sublingual gland.

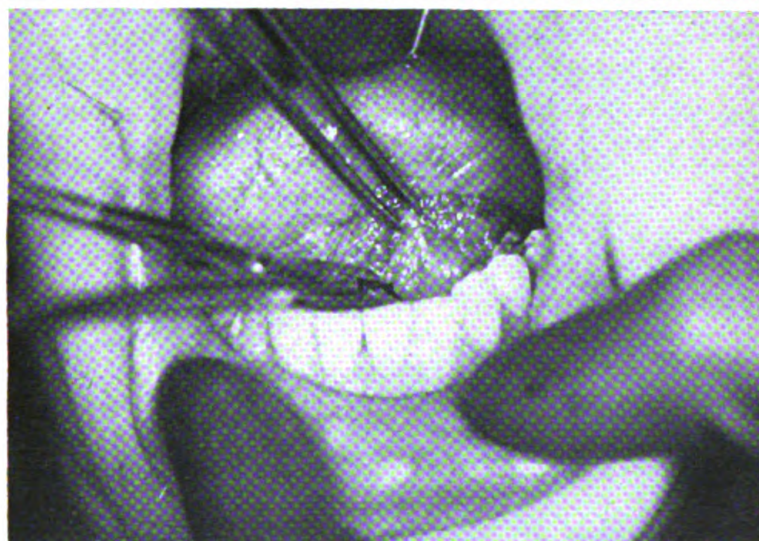


2. Silver probe extending into the sublingual duct.

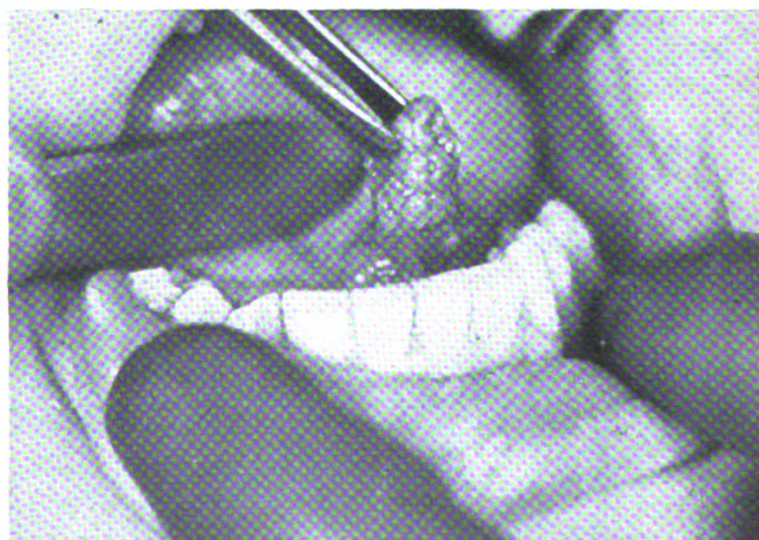
3. Blunt dissection of the sublingual gland.

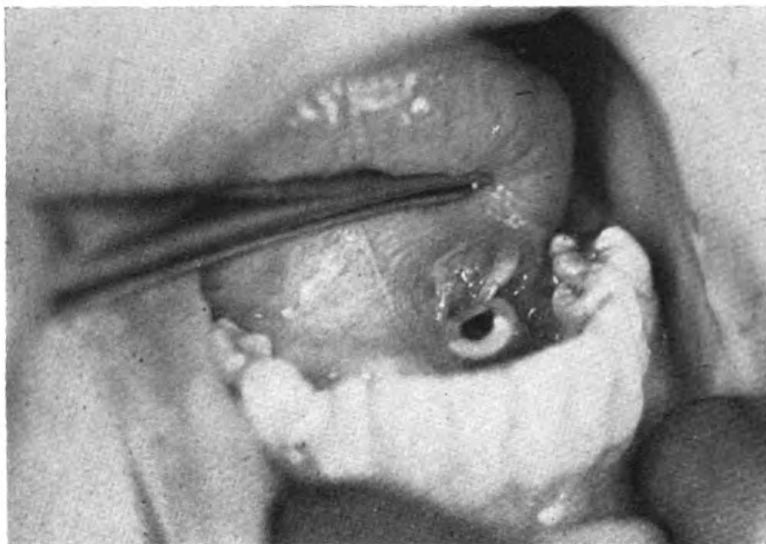


4. A portion of the sublingual gland exposed.



5. The detached portion of the sublingual gland.



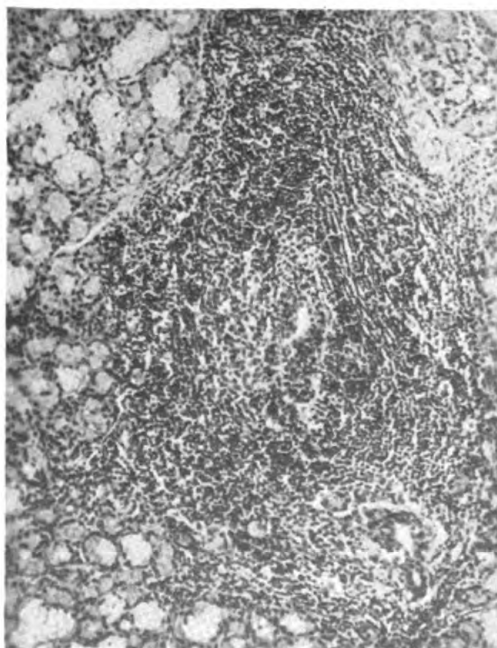


6. Small drain placed in the concavity after removal of the gland.

comfort from a painful swelling, but were not alike in roentgenographic or in clinical findings and in symptoms. Both emphasize the necessity for proper diagnosis.

CASE REPORTS

Case 1.—The patient, a 20-year-old woman, complained of a hard swelling of 1 year's duration in the region of the left sublingual gland (figs. 1 and 2).



7. Photomicrograph showing a dense lymphocytic infiltration obliterating some of the acini and gathered about one of the ducts of the sublingual gland.



8. Photomicrograph of one of the larger ducts which is lined with columnar epithelium surrounded by inflammatory tissue compressing the lumen.

The past and family medical histories were unimportant. Results of roentgenographic examination were negative. On clinical examination a firm, fibrous-like swelling of the left sublingual gland was found. The condition did not change at mealtime, as would have occurred had salivary calculus been the cause.



9. (Above.)
Swelling in
the region of
the submax-
illary gland.



10. (Right.)
Masses of
salivary cal-
culi along
the course of
Wharton's
duct.

Because the presence of the swelling interfered with the patient's speech and with movement of the tongue during mastication, resection of the gland was done.

Using mandibular block and a small amount of regional anesthesia, an incision was made through the mucous membrane of the floor of the mouth and the upper surface of the gland was exposed (fig. 3). By blunt dissection the greater portion of the gland was removed (figs. 4 and 5). Because the gland has no capsule, peripheral remnants remained. A small rubber tube, 5 mm. in diameter, was sutured into position as a drain and was removed 4 days later (fig. 6). Healing was rapid and preoperative discomfort disappeared promptly.

Gross pathologic examination showed that the specimen removed consisted of four pieces of pale gray, slightly congested tissue, measuring from 6 to 15 mm. in diameter, and covered on the surface by numerous papillary processes. On microscopic examination the section was seen to be mixed salivary gland tissue composed of mucous and serous glandular acini. In the interstitial connective tissue stroma there was increased fibrosis, a dense lymphocytic infiltration, some plasma cells, and macrophages in prominent large masses obliterating some of the acini and gathered most conspicuously about the ducts (fig. 7). One of the larger ducts was lined by columnar epithelium and surrounded by an inflammatory tissue which compressed the lumen (fig. 8). The impression was chronic periductal adenitis.

Case 2.—The patient, a 23-year-old man, complained of pain and swelling of approximately 7 months' duration in the region of the left submaxillary gland (fig. 9). The discomfort increased at mealtime. Roentgenographic examination revealed several masses of salivary calculi along the course of Wharton's duct; this was substantiated by clinical findings (fig. 10).

A bulbous-tip silver probe was passed into the lumen of Wharton's duct until the obstruction was contacted, and then an incision was made through the upper wall of the duct to the stones. These were removed and a 5-mm. rubber tube was sutured in the ductal opening for 4 days. Relief from symptoms was immediate.



CONSTITUTIONAL HEPATIC DYSFUNCTION

Constitutional hepatic dysfunction is a condition in which jaundice is due to an inborn inadequacy of the hepatic cells, particularly with regard to excretion of bilirubin. Its sole clinical manifestation is acholuric jaundice. The jaundice may be latent or overt. The essential pathologic finding is an increase in serum bilirubin giving an indirect van den Bergh reaction. It is not due to hemolytic or true hepatic disease or disease of the biliary tract. The prognosis is excellent. Its recognition is important to prevent an erroneously serious prognosis and unwarranted medical and surgical treatment.—COMFORT, M. W.: Constitutional hepatic dysfunction. *M. Clin. North America* 29: 982-989, July 1945.

LUDWIG'S ANGINA TREATED WITH PENICILLIN

REPORT OF A CASE

ALBERT DAVID ALEXANDER

Lieutenant Commander (DC) U.S.N.R.

Reports of recoveries in Ludwig's angina have been of interest because of the high mortality rate in the disease. In onset, clinical progress, and aspect of acute illness with grave prognosis, the following case presented almost a typical textbook picture of the syndrome. The apparent failure of sulfadiazine to halt this rapidly advancing disease prompted the use of penicillin.

Case report.—The patient, 19 years of age, reported to the dental clinic on 10 May 1944, complaining of pains in the left side of the lower jaw. Dental roentgenographs revealed diseased mandibular left second and third molars, and these teeth were extracted under local conduction anesthesia with very slight trauma.

The following morning the patient returned for routine postoperative examination offering no complaints. The area appeared to be healing normally. About 9 hours later on the same day the patient's jaw began to swell and he became conscious of soreness in the throat and tenderness under the left jaw. The temperature was 101.4° F., the pulse rate 96, and the patient appeared toxic. He was admitted to the hospital with a tentative diagnosis of cellulitis, submandibular (left).

The past and family medical histories were irrelevant. Clinical examination revealed a slightly indurated swelling in the floor of the mouth on the left side, associated with some submaxillary swelling. There was partial trismus (about 50 percent limitation). The oral, oropharyngeal, and nasopharyngeal mucosa was not inflamed, with the exception of the left retromolar triangle where the teeth had been removed. The appearance of the tissues at the site of operation was not unusual. There were no other pertinent physical findings. The blood Kahn test was negative. The leukocyte count was 9,450.

Routine treatment was given, including sulfadiazine, saline mouthwashes, multivitamins, and infra-red ray therapy. A blood smear showed gram-negative extracellular cocci which on culture proved to be *Streptococcus salivarius*.

By the third day the swelling involving the tissues of the floor of the mouth had increased considerably and the neck was swollen, indurated, and quite tender. The process had spread to involve the right side, and both sides had a boardlike quality to palpation. Trismus had increased. The patient experienced great difficulty in swallowing and breathing and apparently was in a critical condition. The temperature was 105.4° F., the pulse rate 120, and respirations 28 per minute. The blood sulfonamide level was 6.1 milligrams per 100 cc. of blood. The pus was aspirated and smear

and culture were repeated. X-ray therapy was administered to the left mandible for a total of 77.5 r.

On 15 May (4 days after admission) penicillin therapy was begun. Twenty thousand Oxford units were given intramuscularly every 2 hours. By the following day the patient's condition had improved slightly and continued to improve until his discharge. On 15 May another x-ray treatment was given, in the same dosage. Sulfadiazine therapy was continued and on 19 May the penicillin was reduced to 100,000 units daily. The blood sulfonamide level at this time was 9.8 milligrams per 100 cc. of blood. Three more x-ray treatments were given and on 22 May the penicillin was reduced to 50,000 units daily.

On 26 May the sulfadiazine was discontinued; a total of 54 gm. had been administered. On 2 June there was still a slight nonpainful submaxillary swelling which was slowly subsiding. The penicillin was discontinued on this day; a total of 2,050,000 Oxford units was used. On 9 June the patient was discharged from the hospital well.

COMMENT

It is interesting to note that the change in the course of the disease from almost certain fatality to gradual recovery occurred when penicillin therapy was instituted. The patient was on the "critical list" from 14 May to 22 May. Just how efficacious the penicillin was, and to what extent the x-ray treatments and sulfadiazine therapy aided in resolving the process is difficult to judge; however it is believed that the patient's life was saved by the use of penicillin therapy.



SECONDARY INFECTION IN EPIDERMATOPHYTOSIS

All physicians who have practiced in tropical areas are fully cognizant of the problems caused by fungus infections of the skin, particularly those involving the feet and the ears. These troubles become much more important when secondary infection develops. Development aboard ship of secondary infection in patients with recurrent fungus disease is relatively frequent. Chief among these is miliaria which readily passes on to pustule formation. Both types of these infections are notoriously resistant to local therapy, regardless of its nature.

The following procedure has proved effective in these cases. Along with any of the commonly used local measures, the patient is given five doses of penicillin, of 20,000 units each, making a total of 100,000 units in one day. In a small series of cases the average time required for complete clearing of the skin is about 48 hours.—SHILLING, M.D., Lieutenant (MC) U.S.N.R.

THROMBOPENIC PURPURA SECONDARY TO MULTIPLE MYELOMA

REPORT OF A CASE

HOLLIS K. RUSSELL

Commander (MC) U.S.N.R.

and

BERNARD M. JACOBSON

Lieutenant Commander (MC) U.S.N.R.

Although qualitative and quantitative abnormalities of the erythrocytes and leukocytes are common in multiple myeloma,^{1,2} significant changes in the platelets are rare in this disease. A few such instances have been described.³ The following case is noteworthy for the bizarre clinical picture and for the degree of thrombopenia accompanied by purpura.

Case report.—A 33-year-old officer was admitted to this South Pacific fleet hospital on 21 June 1944 for observation, with diagnosis undetermined. The history was elicited with difficulty, for at all times the patient was mentally clouded. The patient's father was said to have died of aplastic anemia. The past history was not remarkable, although there had been a gradual decline in general health for the past 6 months.

The patient had been in the South Pacific area only a few months, and during the 2 weeks prior to admission was on duty at an outlying advance base. About 2½ weeks prior to entry he noted pain and redness in the tips of the fingers, lasting a few days. About 10 days before admission he began to suffer from malaise and recurrent crampy, generalized abdominal pains, unrelated to the ingestion of food or to defecation. For 6 days before admission he had experienced bilateral low back pain, unrelated to activity and accompanied by intermittent dysuria and the passage of dark, cloudy urine. For 4 days he had complained of a mild nonproductive cough, accompanied by pain in the anterior chest. The patient denied the ingestion of barbiturates, sulfonamides, quinine, or atabrine.

The physical examination revealed the patient to be well-developed, well-nourished, and acutely ill; the mentality was clouded. The temperature was 99.6° F., the pulse rate 96, and the respirations 22 per minute. The sclerae were faintly icteric. The oral hygiene was poor. On the hard palate was one

¹ WINTROBE, M. M.: Clinical Hematology. Lea & Febiger, Philadelphia, 1942. pp. 716-718.

² JACOBSON, B. M.; KRANES, F.; GALL, E. A.; and LINGLEY, J. L.: Diagnosis of multiple myeloma. To be published.

³ ROSENTHAL, N., and VOGEL, P.: Value of sternal puncture in diagnosis of multiple myeloma. J. Mt. Sinai Hosp. 4: 1001-1019, March-April 1938.

tiny petechia. The heart was not remarkable. The lungs were clear. The abdomen was generally tender, particularly so in the right upper quadrant; the liver was slightly enlarged to percussion; the spleen was not palpable. Over the left shoulder and dorsum of both feet were numerous punctate and confluent petechial hemorrhages. The remainder of the physical examination showed no abnormalities.

During the following 6 days the patient became progressively more dull mentally, the temperature rose intermittently to as high as 102° F., and petechial hemorrhages increased in number. Despite supportive treatment, including one transfusion, he died on the eighth hospital day.

Laboratory findings.—X-ray examination of the chest during the course of the illness showed no evidence of pulmonary or of cardiac lesions. Nine examinations of the urine had shown it to be constantly a deep reddish-brown in color, with a low specific gravity, and results of tests for protein (both heat and acetic acid and nitric acid ring tests), and for sediments were essentially negative. Appropriate examinations demonstrated that the abnormal color of the urine was not due to the presence of bile, hemoglobin, melanin, or of homogentistic acid. The urine did not darken on exposure to light; it is presumed, therefore, that it did not contain porphyrins in abnormal concentration. One stool was strongly positive for occult blood.

The blood serum icterus index was forty-three. The serum showed no agglutinins for *Proteus* OXK. The blood urea nitrogen was 54 milligrams per 100 cubic centimeters. The prothrombin time was 32 seconds. The clot retraction was poor. On one occasion the bleeding time was 22 minutes (Duke method), and the coagulation time 10 minutes (Lee and White method). One attempt at sternal bone marrow puncture yielded unsatisfactory material for study.

The formed elements of the blood are presented in the following table.

Formed elements

Date (June 1944)	R.B.C. (millions)	Hemoglobin (grams)	Reticulocytes (percent)	Platelets	W.B.C.
21.....	4.96	14.5	...	.....	9,800
23.....	4.12	14.0	...	.....	8,800
24.....	3.87	14.0	0.5	32,000	6,600
26.....	3.40	13.5	0.6	60,000	.....
27.....	3.85	12.0	3.2	61,000	13,100
28.....	3.75	12.5	1.3	60,000	12,600

Differential count

Juvenile cells	Band forms	Seg. cells	Lymphocytes	Monocytes	Plasma cells
..	10	61	26	3	..
..	6	63	28	3	..
1	18	50	12	17	2
..	8	70	19	3	..
..	7	83	6	4	..

Necropsy.—Necropsy was performed 1 hour after death. There were small areas of hemorrhagic infiltration and larger ecchymotic areas involving the

skin of the extremities and of the anterior and posterior aspects of the trunk.

Both pleural cavities contained about 200 cc. of blood-tinged serous fluid. There were minute areas of hemorrhagic infiltration beneath the visceral and parietal pleura. The right lung weighed 825 grams and the left lung 675 grams. Both lungs on section showed evidence of miliary hemorrhages scattered throughout all the lobes. In addition the lower lobes exhibited patchy areas of consolidation. The hilar nodes were densely anthracotic and mediastinal nodes were enlarged and moderately anthracotic.

The heart weighed 325 grams. There were many small areas of hemorrhagic infiltration beneath the visceral and parietal pericardium which also exhibited a fine fibrinous exudate. The pericardial sac contained 100 cc. of blood-tinged turbid fluid. Section of the heart revealed numerous areas of subendocardial hemorrhagic infiltration. The valves and vessels were normal.

The abdominal cavity contained 400 cc. of blood-tinged serous fluid. There were many minute areas of hemorrhagic infiltration beneath the visceral and parietal peritoneum.

The spleen weighed 425 grams. The organ was firm in consistency and the cut surface reddish-brown in color, presenting a homogeneous appearance. The malpighian corpuscles were not prominent. The liver weighed 2,050 grams. It was reddish-brown in color and the cut surface revealed a moderate congestion. The gallbladder and biliary ducts were normal.

The kidneys weighed 300 and 325 gm. respectively. The capsules stripped with some difficulty, leaving a slightly granular, pale yellowish-brown surface. Bisection showed the parenchymal markings to be obscure. The cut surface was a pale brownish-yellow. The pelves showed small areas of hemorrhagic infiltration into the mucosa.

The brain presented small subarachnoid areas of hemorrhagic infiltration over the vertex of each hemisphere, and congestion of the vessels of the pia-arachnoid. On section the brain revealed evidence of congestion and edema throughout the cerebrum and the brain stem.

The bone marrow of the ribs, sternum, vertebrae, and skull was hyperplastic, but no areas of softening or bone destruction were noted.

Sections of the heart revealed small areas of hemorrhagic infiltration beneath the endocardium, and to a lesser extent throughout the cardiac muscle. In some areas the myocardial fibers were swollen and had large pale-staining nuclei.

Sections from the lungs presented peribronchial collections of cells composed of plasma cells, lymphocytes, and occasional granulocytes. Occasionally similar collections of cells could be seen infiltrating the lung parenchyma. Many areas of hemorrhagic infiltration involving several alveoli could be seen throughout the lung parenchyma. Sections from the lower lobes showed an extensive lobular pneumonia.

A moderate degree of central congestion of the liver was noted, and there was moderate thickening of the capsule. Surrounding many of the central canals were collections of cells, composed largely of plasma cells and lymphocytes. Similar collections were also seen in different parts of the liver lobules. Kupffer cells were prominent and contained hematogenous pigment.

The spleen was moderately congested, and the capsule thickened; the pulp was infiltrated by many plasma cells, and the follicles appeared compressed and moderately atrophic. Sections of both kidneys exhibited hyaline masses in the glomerular capillaries, with numerous glomeruli showing extensive hyalinization. Many of the tubules contained hyaline casts. There was wide-

spread infiltration of the interstitial tissues by plasma cells and round cells. Many of the tubules were greatly dilated and others were filled with blood.

The mediastinal lymph nodes presented a distortion of the normal architecture by widespread anthracosis and infiltration of the pulp by plasma cells. The follicles were compressed and atrophic. The mesenteric nodes exhibited diffuse hyperplasia with infiltration of the pulp by plasma cells, and of the sinusoids by plasma cells and a few granulocytes.

Sections of the brain and brain stem revealed evidence of edema and congestion.

The differential count of the marrow cells of the vertebrae showed the following distribution:

<i>Cells</i>	<i>Percent</i>
Myeloblasts	3.0
Premyelocytes	4.5
Neutrophilic myelocytes	11.0
Eosinophilic myelocytes	2.0
Neutrophilic juveniles	6.0
Eosinophilic juveniles	3.0
Basophils	1.0
Band forms	4.0
Mature neutrophils	2.5
Lymphocytes	1.5
Plasma cells	32.5
Megakaryocytes	1.0
Normoblasts	24.0
Macronormoblasts	4.0
	<hr/>
	100.0

The percentage of plasma cells was distributed as follows: Vertebra, 32.5; rib, 25.7; sternum, 22.0; skull, 27.4; and spleen, 21 percent.

COMMENT

During life the clinical picture and laboratory findings were compatible with a diagnosis of primary purpura haemorrhagica. The anatomic findings, with widespread infiltration of many organs and of the bone marrow, were those described as occurring in plasma cell leukemia. At no time, however, did the peripheral blood exhibit leukemic findings. In plasma cell myeloma, diffuse infiltration of the marrow by plasma cells has been frequently described, and sternal biopsy has often established this diagnosis.

In the present case there was a diffuse and uniform infiltration of the marrow in the bones studied. The widespread destructive lesions of bones, described as occurring in approximately 50 percent of all persons with myeloma,² were not present in this case. Thrombopenia has occurred more often in leukemia than in primary bone tumors. It is the opinion of the authors that plasma cell leukemia and plasma cell myeloma are anatomically identical.

MEDICAL AND SURGICAL DEVICES

PLASTER FIXATION: A POSTOPERATIVE DRESSING FOR FELON

CHARLES W. McLAUGHLIN, JR.
Commander (MC) U.S.N.R.

In civilian life, felons (distal pulp space infections) are encountered most frequently in women as a result of injuries incident to working with steel wool, pins, needles, and thorny flowers or shrubs. In Naval practice at sea, deck personnel handling lines and crated stores, aviation mechanics with aircraft maintenance divisions, and mess cooks have presented themselves in considerable numbers with these lesions.

The clinical picture, characterized by intense pain in the involved digit and exquisite tenderness with a variable amount of induration, is well known to all. Prompt surgical drainage is imperative because of the compartmentation of this closed pulp space and the anatomic arrangement of the terminal digital vessels which predispose to early necrosis of the bony diaphysis.

Aboard ship, anesthesia has been obtained by digital nerve block in the proximal phalanx of the affected finger. This form of anesthesia has proved entirely safe and satisfactory when certain precautions are observed.

1. It should never be used when there is any evidence of cutaneous infection in the area selected for nerve block. In such instances administration of a general anesthetic is more desirable.

2. Procaine hydrochloride without epinephrine in a 1- or 2-percent solution is employed. Two or 3 cubic centimeters of this solution diffused along each side of the phalanx, and particularly along the palmar angles of the bone, will give excellent anesthesia if gentle massage of the injection sites is carried out for several minutes before proceeding with the incision. The use of epinephrine in the procaine solution is to be avoided because of the risk of digital gangrene from prolonged vascular spasm.

3. A rubber band tourniquet is desirable to permit incision in a bloodless field, but its use should be limited to the shortest possible period. It is recommended that the tourniquet be placed just

proximal to the distal phalanx immediately before incision and removed as soon as this is completed.

The compartmentation of the distal pulp space necessitates either the employment of a "hockey-stick" or "fish-mouth" incision to insure drainage of the numerous closed spaces which may harbor infection. If the knife is carried from its lateral point of entrance completely through the entire pulp space until it may be felt beneath the skin on the opposite side, the "hockey-stick" incision will usually suffice. When any question about the adequacy of the surgical drainage exists, a completion of the U-shaped incision is desirable. The incision must be carried proximally far enough to assure drainage of the entire distal pulp space, but must not be extended past the proximal fascial barrier. Medial and lateral incisions with through-and-through drainage are, in general, unsatisfactory in this type of lesion.

The usual postoperative care of a felon includes the insertion of a rubber-dam wick for 2 or 3 days, and frequent warm boric acid soaks during this period, followed by dry dressings until the incision has completely healed. This ordinarily requires from 3 to 4 weeks in the absence of actual bone involvement with osteomyelitis.

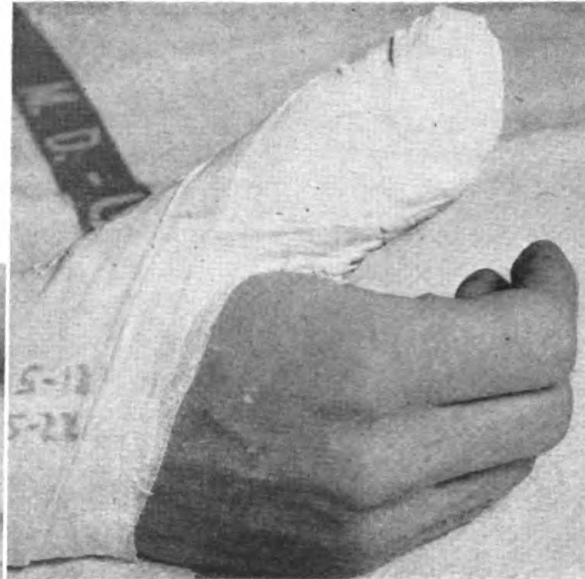
It has been repeatedly observed that the exquisite tenderness which persists in the digit following incision prevents these patients from carrying out any manual work for a period of approximately 1 week. During this time the several dressings necessary are painful experiences, and with the eventual cessation of drainage and healing, the pulp space evidences a variable degree of deformity, depending upon the amount of soft tissue destruction.

In an effort to obviate some of these unpleasant features, the following type of postoperative dressing has been adopted. The incision is completed and the pulp space gently wiped free of all liquid necrotic material. Gauze or a rubber-dam wick is not left in the wound, but a small amount of sterile vaseline or petrolatum is placed below the lips of the wound to keep these from closing prematurely. A gauze dressing is then applied and anchored at the wrist with a 1-inch bandage.

Using narrow rolls of plaster of paris, a cast is applied about the finger, supported on the dorsum of the hand by a narrow plaster splint and fixed by incorporating the wrist (fig. 1). The patient is permitted to return to his station as soon as the plaster bandage is firm, with a request for 24 hours of light duty. Aspirin is provided for pain, and instructions are given to keep the hand elevated as much as possible during the first day following incision.

It has been gratifying to note how much more comfortable these patients are than those treated by simple dressings and repeated boric acid soaks. Pain is usually no longer a feature after 24 hours and the protection and support given by the light plaster dressing permits the carrying out of a surprisingly large percent of assigned duties in complete comfort. The original dressing is removed in 10 or 12 days, at which time the incision presents a

1. (Right). Plaster cast applied to thumb following incision of felon.



2. (Left). Appearance of right middle finger 14 days after "hockey-stick" incision and 2 days after removal of supporting plaster cast.

clean granulating line (fig. 2). Firm gauze dressings are then employed until healing is complete.

The apparent advantages of this postoperative dressing are: (1) A great increase in the patient's comfort, particularly during the first few days when rest through splinting is supplied; (2) a reduction in the number of dressings and discontinuance of hot soaks with limitation of the possibilities of secondary infection; (3) an early return to a duty status; (4) more prompt healing; and (5) a decrease in the amount of ultimate deformity of the finger tip as a result of more prompt healing.

This type of dressing has been employed in 15 consecutive felon operations without bone involvement with excellent results.

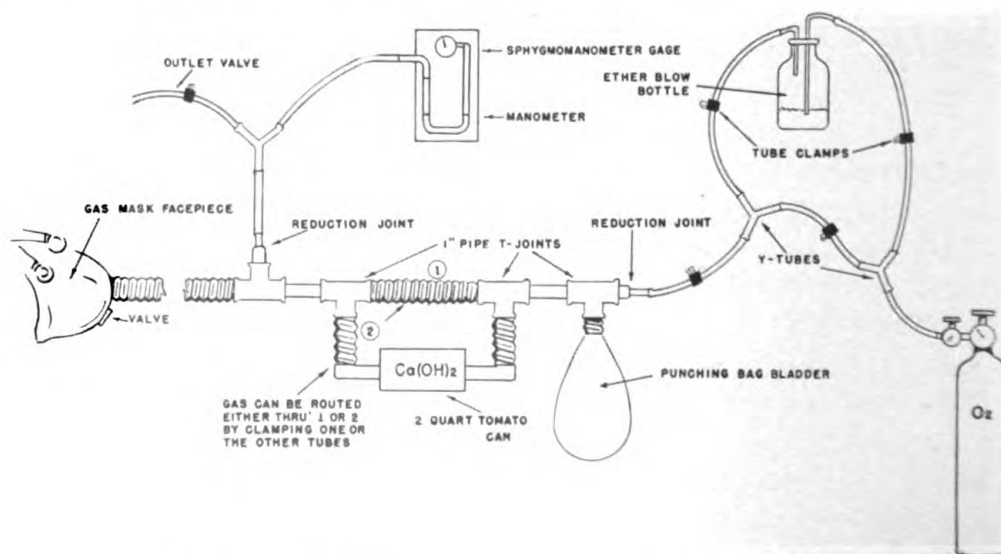
HOMEMADE ANESTHESIA MACHINE FOR SMALL MEDICAL FACILITIES

GEORGE C. MANNING, JR.

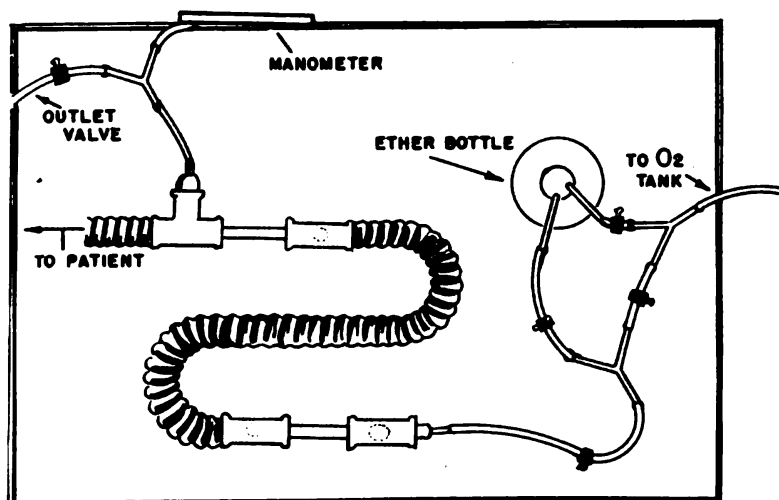
Lieutenant, junior grade (MC) U.S.N.

The medical and surgical supply allotments to the smaller ships of the fleet are usually quite limited, yet many of these smaller ships, especially LSTs, are frequently designated as auxiliary hospital ships or casualty evacuation ships for amphibious operations. These ships carry a surgical team, and their physical plant is altered so that there is adequate ward space and operating room space instead of the usual cubbyhole sickbay, and the wardroom table. The supply of surgical equipment in these ships, however, is not greatly increased, and a gas anesthesia machine is never aboard. Although spinal, local, and pentothal anesthetics are sufficient to handle the majority of casualties, an occasional patient requires an inhalation anesthetic, and for patients with thoracic wounds, positive-pressure anesthetic may be of considerable aid.

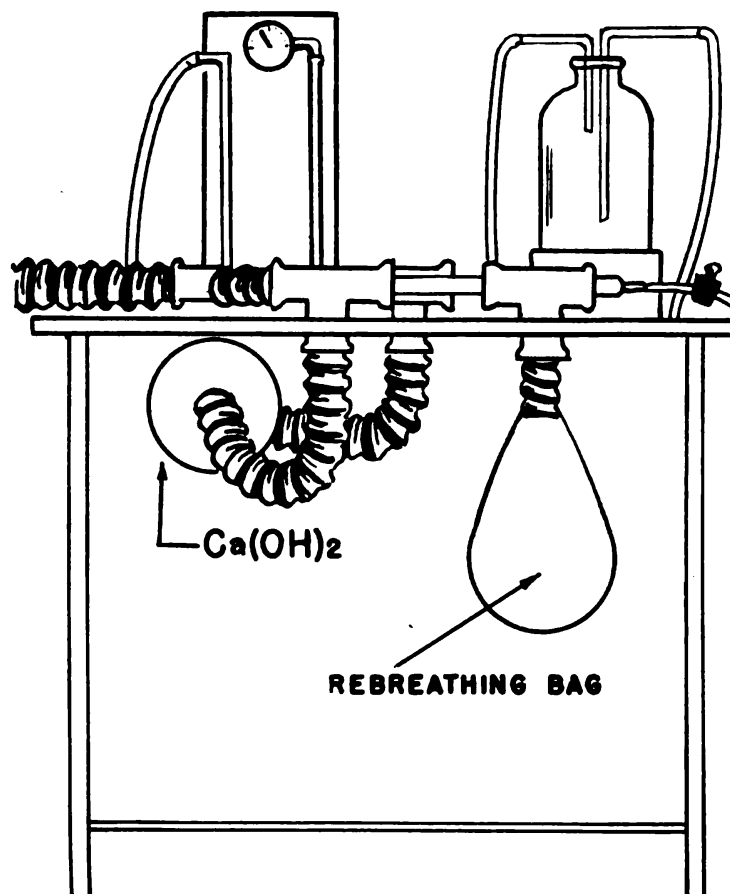
Open-drop ether is ineffective, hazardous, and disagreeable for shipboard use because of the temperature aboard ship and because the vapor is spread throughout the entire ship by the blowers. Positive-pressure anesthesia can be obtained only with a closed system. For this reason a gas-anesthesia machine was designed



1. Diagram of improvised anesthesia apparatus assembled.



2. Top projection of plywood board with apparatus assembled and wired in place.



3. Improvised anesthesia apparatus mounted on plywood board and sitting on angle-iron table frame.

and built on one casualty evacuation ship.

As gas cylinders were not attainable, ether was used as the

anesthetic agent. The machine was constructed completely from material obtainable aboard ship, and differed in basic design from commercially built machines only in the method of introducing ether into the system. Oxygen was supplied from a cylinder of commercial gas such as is used for an oxyacetylene torch.

Tracheal intubation was not feasible because there was not a trained anesthetist or endoscopist aboard. A tight-fitting old-type Army gas mask was used. All the parts except the rubber portion of the mask which covers the nose and mouth, and which contains the inlet and the valve, were discarded. The valve was sealed with adhesive tape, and in order to make the mask easier to handle, the clips holding the head strap to the mask were pulled out on the left side, leaving a small hole through which buttons sewed to the ends of the head strap secured the mask. The rebreathing bag was a punching-bag bladder with a hole cut in the top.

The carbon dioxide absorber was made from an empty 2-quart tomato can to which was soldered a short length of copper pipe at each end. Three-way connections were made with ordinary 1-inch T-shaped pipe joints. Rubber connections were Army gas-mask tubing, with the exception of the connections to the carbon dioxide absorber which were from a Navy gas mask because of the convenient right-angle bend at one end of the tube. Ether was supplied from a bubble bottle such as is used for tonsillectomies; a 1,000-cc. saline solution bottle was used, although a smaller bottle would have been preferable. The manometer was a simple U-tube filled with an eosin solution. It was mounted on a board sufficiently solid so that the pressure gage of the sphygmomanometer could be attached. The oxygen, ether, manometer, and outlet connections were made with glass Y-tubes, and rubber infusion tubing. Tube clamps were placed at strategic points.

Figure 1 is a schematic diagram of the apparatus. The entire apparatus was mounted on a plywood board and wired in place. This board was 24 inches long and 18 inches wide, but the size is unimportant. The board was mounted on a welded angle-iron frame 30 inches high. Figures 2 and 3 show different views.

The gases were routed either through the calcium hydroxide container or directly to the rebreathing bag by placing a large clamp on one or the other leg of the connection. This clamp was constructed from a large spring paper clip to which two wooden wedges were attached so that the arrangement worked like a large clothespin.

The manometer was calibrated by having a number of persons breathe oxygen through the machine and noting the normal respiratory excursion.

PROBLEMS IN SURGERY ON A DESTROYER

CASE REPORT OF ACUTE INTESTINAL OBSTRUCTION

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The medical department of a destroyer is not set up to do elective surgery. Even minor surgical procedures are best handled at hospitals and dispensaries ashore or aboard larger ships where equipment is more adequate, more experienced help is available, and where the opportunity for sterile operating conditions is greater. A very important function of the medical department, however, is to care for emergency cases or render adequate first aid until the patient can be transferred to a larger activity.

Emergency surgical cases will frequently occur and then it is necessary to administer the best surgical care with the facilities available. When the facilities are inadequate and it becomes necessary to improvise, frequently the opinions of those who have had years of experience aboard destroyers, even though they are neither physicians nor medically trained, can be used to the greatest advantage.

The following case report describes an experience aboard a 2,100-ton (Fletcher class) destroyer:

Case report.—A 20-year-old gunner's mate, third class, reported to the sickbay about 1500, complaining of pain in his abdomen and an associated episode of vomiting. The onset of these complaints was sudden, about 1 hour previously. Two hours before that he had a normal bowel movement with the passage of gas. Physical examination revealed that the patient's abdomen was not distended. There was a healed scar over the lower right rectus muscle which resulted from an uncomplicated appendectomy 6 years before. There was very slight generalized abdominal tenderness but no muscle guard, rebound tenderness or borborygmus. Rectal digital examination was unrevealing. The patient's temperature was 98.6°F., pulse rate 75, and blood pressure 120/80. He was confined to his bunk and observed at frequent intervals.

About 2400 the same day it was noted that his pain was of a cramping, colicky nature. He complained of gas on his stomach and said he was unable to pass gas. There was no change in the abdominal physical findings. Temperature, pulse, and blood pressure remained the same, and he slept at intervals during the night. At 0800 the next morning he still complained of intermittent pain, vomiting, and inability to pass gas. It was noted at this time

that very moderate distention was present. Tenderness was still moderate and generalized. Temperature, pulse, and blood pressure remained the same and urinalysis showed nothing pertinent. Leukocyte count was thirty thousand. A Rehfuß tube, the only tube available, was inserted into the stomach and an improvised Wangensteen apparatus for continuous suction was set up. The returns from the stomach were yellowish brown in color and had a slight fecal odor. One thousand cc. normal saline was given intravenously.

During the afternoon the pain shifted to the right lower abdominal quadrant, with tenderness over the old operative scar. Borborygmus was now audible over the entire abdomen but loudest over the operative scar. It was apparent that surgery was imperative.

The operation.—Morphine sulfate, $\frac{1}{4}$ grain, and atropine sulfate, $\frac{1}{500}$ grain, were given hypodermically and sodium pentobarbital, $1\frac{1}{2}$ grains, rectally. A right paramedial incision was made just medial to the old operative scar and the peritoneal cavity entered. Sanguineous fluid appeared as well as an infarcted loop of gut. The strangulating factor was an adhesion which seemed to extend from the ileum to the lateral abdominal wall. This was incised, releasing the entire gut. The nonviable portion measured about 18 inches. It was deep purple to black in color. It had lost all power of contraction and there was absence of pulsation in the mesenteric arteries along the border of the bowel. This area of ileum was resected and a side-to-side anastomosis about 8 inches proximal to the ileocecal valve performed. Ten grams of sulfanilamide was placed in the peritoneal cavity and the abdomen was closed around a rubber catheter used as a drain.

Postoperative course.—The return trip to the Naval air station dispensary where the patient was transferred took about 42 hours. During the return trip continuous suction with the Wangensteen apparatus was maintained. An intravenous fluid intake of 3,000 cc. daily maintained a normal urinary output. Continuous nasal oxygen at the rate of 4 liters per minute was administered.

On arrival at the Naval air station dispensary the following were the physical and laboratory findings: Temperature 101.4°F., pulse rate 106, respirations 22, blood pressure 140/80, leukocyte count 4,050, and blood sulfanilamide 1.5 mg. per 100 cubic centimeters. Urinalysis results were within normal range.

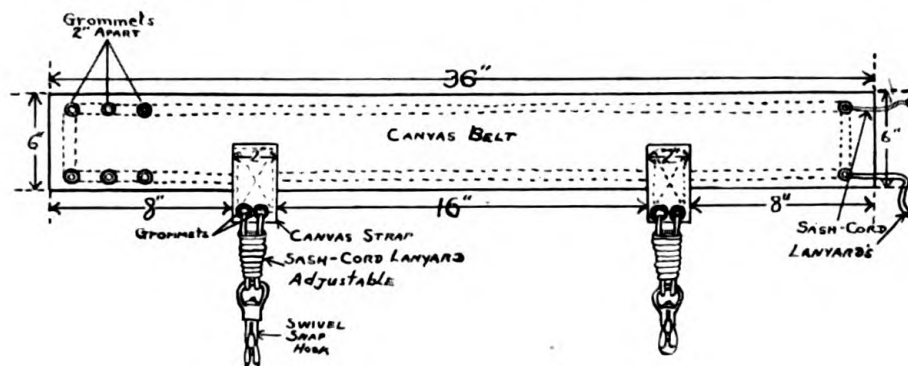
Five hundred cubic centimeters of whole blood was given and because of the probable increase in peritoneal contamination, 300,000 units of penicillin were administered at the rate of 20,000 units intramuscularly every 3 hours. Liquids with the tube clamped were started on the sixth postoperative day. Drains and Rehfuß tube were removed on the eighth postoperative day. There was a moderate nonfecal discharge from the drain site which gradually subsided. The patient was discharged from the dispensary and returned to the ship 32 days after operation.

COMMENT

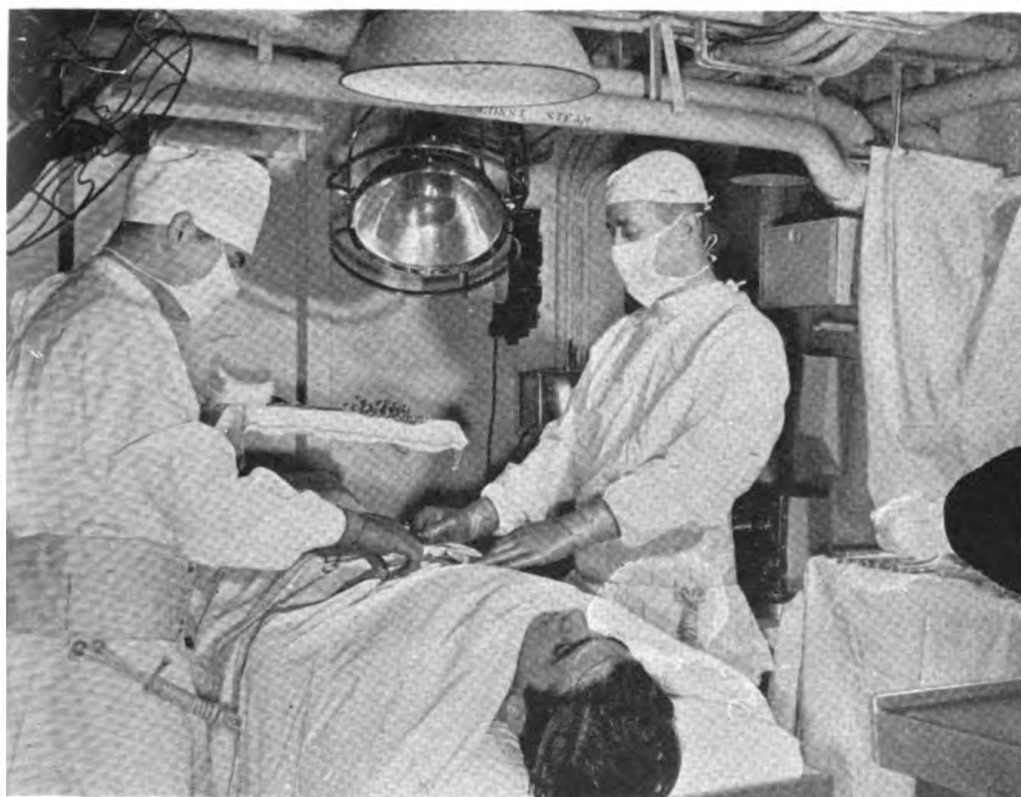
When this emergency presented itself the ship was in enemy waters and action was impending. General quarters was expected at any minute. Extremely adverse sea and weather conditions existed which produced adverse operating conditions aboard the light destroyer. It was necessary to take every precaution to prevent sterile instruments from falling on the deck, to reduce the

motion of the patient on the operating table, and to prevent personnel who were busily engaged in the actual care of the patient from falling. Fortunately shortly after the operation began, operating conditions became less hazardous due to the fact that the ship changed course and speed.

The use of a canvas belt designed by the ship's skipper, Commander Thomas J. Thornhill, Jr., U.S.N., made the operation rela-



1. Diagram of stabilizing canvas belt.



2. Operative setup in sickbay aboard a destroyer. There is adequate space and all equipment is readily accessible. Surgeons secured to table by canvas belts.

—Official U. S. Navy Photo.

tively easy despite the bad weather (fig. 1). The belt has been used mainly by those who stand watches in the communications and control room and has been found very effective in a rough sea. Medical personnel, by employing it in the sickbay when treating casualties or performing surgical procedures in a rough sea, have found it an effective device.

Figure 2 illustrates the practical application of the belt during a surgical procedure. If the wardroom table is used as an operating table, special rings must be attached which will receive the swivel snap hooks. The belt is adjustable and will fit any size



3. A Stokes stretcher suspended from the overhead facilitates smooth transportation of the surgical patient. There is adequate space for necessary nursing care.

—Official U. S. Navy Photo.

waistline. The sash cord lanyards are also adjustable for distances from which one wishes to stand away from the table. It can be wrapped in muslin and autoclaved, thus eliminating, or at least reducing, the chance of contaminating the operative field. The main advantage of this type of belt is stability, which in turn produces a sense of security. A medical officer cannot give his undivided attention to the patient on the operating table if he is constantly fearful of a sudden unexpected ship's roll or pitch which may drop him on the deck or throw him against a bulkhead. It is also restful in that it reduces the amount of energy necessary to maintain balance. This factor will be of utmost importance when one is treating a large number of casualties.

In order to give the patient a comfortable postoperative convalescence during the trip back to the base, a suspended Stokes stretcher bunk was devised as illustrated in figure 3. It was in this position that the patient rode the entire distance back to the base and it was in this same stretcher that he was transferred by picket boat to the dispensary. The principle of the Stokes stretcher suspended from the overhead in the sickbay is similar to that of the hammock used as a bunk. The stretcher, however, adds a smooth, firm surface which is necessary immediately after an abdominal operation. Had the patient been placed in the most comfortable bunk on the ship, since the bunks are firmly fixed to the bulkheads and overheads, he and the bunk would have rolled and pitched with each roll and pitch of the ship. Instead as the ship rolled it seemed to move around the stretcher, leaving it almost stationary. The pitch did not create enough motion in the stretcher to be uncomfortable.

By suspending the stretcher in the sickbay, movement of the patient immediately after the operation was reduced to the minimum. Had he been removed to his bunk it would have necessitated moving him topside and down a narrow ladder. From the illustration it may be seen that adequate space was available for the Wangenstein apparatus for continuous suction and for the administration of nasal oxygen and intravenous fluids, which are so necessary to the patient who has had an intestinal resection.



NONALLERGIC, NONINFECTIOUS ASTHMA

Nonallergic, noninfectious asthma is subdivided into asthma due to: Physical allergy, bronchial stenosis, psychosomatic references, acute left ventricular failure (cardiac asthma), emphysema with wheezing, so-called "intrinsic asthma," and that due to the nasobronchial reflex from nasal foreign bodies and polyps, obstruction, or foreign bodies; wheezing only on exertion; preponderance of unilateral signs or symptoms during or between acute paroxysms; localized inspiratory stridor which persists; dyspnea which is chiefly inspiratory; relief of nocturnal dyspnea by digitalization. Physical and psychosomatic asthma are amenable to therapy. The prognosis is poor in other kinds of asthma in this group. Response to treatment is usually transient. The allergist must be trained in internal medicine to deal fairly with this group. Pure forms of A, B, and of the subdivisions of D are the exception when asthma is chronic and of long standing.—EDITORIALS: Classification of asthma. *J. Allergy* 16: 199-200, July 1945.



DOES DICUMAROL PREVENT THROMBOSIS?

The evidence comes largely from statistical studies of postoperative patients. At the Mayo Clinic it was shown that among 678 patients who had a pulmonary embolism and survived and who did not receive dicumarol, 297 (43.8 percent) had one or more subsequent episodes of thrombophlebitis or pulmonary embolism, and 124 (18.3 percent) had a subsequent fatal pulmonary embolism. Among 180 similar patients who had pulmonary embolism and survived and did receive dicumarol, only 2 (1.1 percent) had subsequent thrombophlebitis or embolism, and only one (0.6 percent) had a subsequent fatal embolism. Also among 897 patients who had postoperative thrombophlebitis (or phlebothrombosis) and who did not receive dicumarol, 95 (10.6 percent) had one or more subsequent episodes or extensions of the thrombophlebitis, and 51 (5.7 percent) had subsequent fatal pulmonary embolism. Among 138 similar patients who received dicumarol, 4 (2.9 percent) had more thrombophlebitis and none had fatal embolism.—BARKER, N. W.: Clinical use of dicumarol. *M. Clin. North America* 29: 929-935, July 1945.

EDITORIALS

LITTLE-RECOGNIZED CAUSE OF LOW BACK PAIN

Increasing interest is being given to the problem of localized tender spots in the back with associated referred segmental pain. Ever since Steindler¹ called attention to the presence of sharply defined pressure or trigger points in the back, injection of which with local anesthetic agents resulted in the disappearance of low back pain, investigation has been directed to the pathologic mechanism involved.

Certain morphologic factors, principally of anatomic variations, have been suggested as producers of pain low in the back, but in most instances no convincing causal connection could be established.

The present tendency to regard all low back pain as related in some manner to a slipped intervertebral disk² is pernicious. The many painful backs of the past which improved under conservative management with immobilization should give pause to surgeons quick in the use of the knife for distressing back complaints.

The post-exercise stiffness and pain in the region of the back, particularly in persons of sedentary habits, is so universal that the entity has received little serious consideration. Clinicians were reluctant to ascribe the pain and stiffness to anything but soreness due to the stretching of unused muscles. The painful nodules frequently found in the back by the physician's examining fingers but unrevealed by the surgeon's scalpel were discredited as being of any clinical consequence, much less associated with a fibrositis. Furthermore, fibrositis as a pathologic entity has long been viewed with skepticism.

Recently, however, Copeman and Ackerman³ have shown that the tender spots of the back often referred to as trigger points, tender rheumatic nodules, or myalgic spots are coincident with

¹ STEINDLER, A.: Differential diagnosis of pain low in back; allocation of source of pain by procaine hydrochloride method. J.A.M.A. 110: 106-112, January 8, 1938.

² EDITORIAL: Intervertebral disks. U. S. Nav. M. Bull. 45: 771-772, October 1945.

³ COPEMAN, W. S. C., and ACKERMAN, W. L.: Fibrositis of back. Quart. J. Med. 13: 37-51, April-July 1944.

deposits of pink fat lying between the superficial and deep fascia of the back in a so-called potential space which ordinarily contains little or no fat. The deposits are arranged according to a basic pattern, even in the most grossly emaciated bodies, and found associated with tendons, their synovial sheaths and where the fascia splits to invest a muscle.

It was suggested that because of the vascular character of the fat it may become edematous and congested, narrowing the lumen of the tendon sheath, impeding its action and causing the stiffening and tightness which precedes the definite characteristic pain by some hours. The hypothesis was based on the dissection of 14 backs in which herniation of the fat lobules through fascial weaknesses, deficiencies, or foramens was frequently found, according to a pedunculated, nonpedunculated, or foraminal pattern.

Application of the anatomic observations to clinical conditions in the living confirmed the hypothesis regarding the origin of "fibrositis" and low back pain in 10 patients, the pain being caused by a temporary or permanent increase in tension in fat which is confined within a distensible fibrous covering or sheath. Strangulation was demonstrated at operation and treatment consisted in excision or needling of the herniated mass, both methods bringing about lasting results.

Still more recently this relationship of fat herniation to pain in the back was corroborated by Herz⁴ who removed a herniated mass of fascial fat in six patients, the removal being followed by prompt relief in each instance. The pain was extremely severe in all and in some was referred down one leg. Two patients had had recurrent attacks of acute lumbago for 15 years which had been incapacitating, requiring bed rest. One patient could not turn in bed during the exacerbations. In each of the six, a definite mass was palpable and extremely tender, pressure on it intensifying the pain. Temporary relief, however, could be obtained by injecting the masses with a local anesthetic solution.

Regarding the origin of the trigger points, it was observed that in pyrexial illnesses such as influenza, the exanthemas, malaria, and infective hepatitis, the racking pain of the back passes at the end of the pyrexia but the trigger points persist unknown to the patient and can be detected only by tenderness on palpation. It is thought that this process constitutes the basis for fibrositis at a later date when further injury or infection reactivates the condition, gradually evolving into a seat of chronic pain.

⁴HERZ, R.: Herniation of fascial fat as cause of low back pain. J.A.M.A. 128: 921-925, July 28, 1945.

The evidence presented by these investigations establishes a reasonable explanation of the trigger point and referred segmental pain phenomenon as seen in back complaints. It is apparent that the hypothesis is not intended to answer the causal relationship of all low back pain. There are other well-established reasons for this distressing malady. Moreover it must be remembered that open surgery may not reveal a definitely palpable fat nodule any more than is operation a cure-all for every painful back; injection of local anesthetics has given remarkably quick relief in many of the puzzling disorders of the back, resort to which should be made before any consideration of open surgical exploration. (S. A. Z.)

RUSSIAN NAVAL MEDICAL SERVICE

Much has been written about the high attainments of Russian medicine during the present war. Major General Andreyev's commentary elsewhere in this BULLETIN (p. 831), shows how stupendous the task that challenged Soviet Medicine. How well that task was accomplished is a matter of history.

Wars are won or lost according to the quality of preventive medicine practiced among the military forces. It is apparent that prevention is a leading principle of Russian medical science. Soviet public health has not only withstood the test of war but brought to its country a standard of health materially improved over peacetime.

Despite the shifting of whole industries over large distances, and the dislocation of huge segments of population, not only were there no mass epidemics such as usually accompany war, but as Andreyev has pointed out, the incidence of sickness and particularly contagious diseases has remained the same as that observed during peace.

Commendations over the success of Russian medicine in the treatment of war wounds have been effusive, particularly from the lay press. That there is much to admire in the Soviet handling of her war injured is shown by the numbers of casualties returned to her fighting ranks. This, however, must not be interpreted as peculiar to Russia. Surgical principles are recognized by well-trained surgeons,¹ whatever the country to which they attach their allegiance. The technic of applying these principles, however, may differ between countries, and close liaison between allied powers was not restricted strictly to military operations. The

¹ DAVIS, L.: Organization of Red Army Medical Corps. Surg., Gynec. & Obst. 79: 329-332, September 1944.

wonderful conquests of medicine that followed stand upon their own merit and are shared in by all the allies even as the victory.

The single outstanding contribution to Russian success, on the other hand, may be written in the one word, organization. Russia learned early the need and advantage of careful planning. She has had a rich battle experience on which to fall back. The shortcomings in the care of the fighting force were quickly ferreted out and their correction put upon a scientific basis.

It is this foresight and this care of details that have characterized Soviet war medicine. It has reached out to all branches of the service and no one can read Andreyev's report without being impressed with the high degree of organization obtained in the medical service of the Russian Navy. That it was an integral part of the armed force can be seen by its pervading activity through every phase of military operation. Its contribution to victory cannot be easily measured. (S. A. Z.)

NAVY CHOW

Nutritional studies have recently assumed prominence in military medicine. No longer are rations handed out on the basis of what is at hand. Subsistence standards are not enough. It is realized that a fighting man to be an effective instrument of war must be of a physical stamina unweakened even by inroads of the many insidious deficiencies.

McCay and his associates, elsewhere in this BULLETIN (p. 903), have portrayed the trends in Naval diets. Lighter meals of fewer calories have the advantage of supplying nutritive food without wastage. The tendency toward consumption of milk and avoidance of the omnipresent soft drink creates better oral as well as general health.

Attention, moreover, is paid not merely to what is eaten but how it is prepared. It is to the credit of medical science that epidemics of dysenteries have not created situations inimical to military operations, and this despite exposure to endemic areas teeming with diseases of the alimentary tract. It can be said no major epidemic of diarrheal or dysenteric origin seriously interfered with any planned operational program during this war—a factor that contributes no small part in deciding the outcome of the most brilliant military plans. (S. A. Z.)

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

THE GOVERNING OF MEN, General Principles and Recommendations based on Experiences at a Japanese Relocation Camp, by *Alexander H. Leighton*, Lieut. Comdr. (MC) U.S.N.R. 404 pages; illustrated. Princeton University Press, Princeton, N.J., publishers, 1945. Price \$3.75.

"The Governing of Men" is a study of the evacuation of the Japanese from the Pacific coastal region of the United States and their resettlement inland. Lieutenant Commander Alexander H. Leighton (MC) USNR was sent to the Japanese Relocation Center at Poston, Arizona, by the Navy, the Office of Indian Affairs, and the War Relocation Authority to study the project scientifically. The result of his research is not only a thorough, though bird's eye view of the whole problem of these American évacués, but has wide implication as a sample of such movements and mingling of peoples in other parts of the world. The book would seem invaluable to those concerned with the occupation of Germany or Japan.

In the governing of man, in the broad sense, in wartime, to achieve the greatest good for the greatest number, it is inevitable that some injustice will be done to minorities. And the presence of the Japanese Americans in large numbers on our West Coast constituted a national emergency. But no matter how one rationalizes the act of relocation, it must be concluded that the procedure will forever remain one of the darkest blots upon our democracy. It was one of those things that "can't" happen in America, and retribution may be felt for a long time to come in our courts and in a small, embittered group who are, in the final analysis, American citizens.

The very colorful first chapter of this book summarizes the situation and how it arose. By skillful alternating of quotations from newspapers, from official documents, and from the Japanese themselves, the author paints the picture of what happened and how evacuation came about. And he pictures the Japanese—Niseis, Isseis, and Bibeis—as they had been living.

"These were the Japanese, not one type, not one cultural pattern, but men and women and their children, large and small, fat and thin; the virtuous and the rascals; of different layers in society, of all degrees of education and all degrees of Americanization and Nipponization."

There can be little doubt of the deprivations and injustices suffered by this group because there was no time for screening.

The author succeeds in being very practical; he has picked the salient details of personalities of the governed, of conflicts, both large and small, of the weather and the smells and the discomforts, that immediately confronted the governors of the camp, nor does he spare the administrators in pointing out where they bungled and where experiments failed. He was there during a strike by camp members and this is analyzed with understanding. The outline under the chapter heads in the table of contents attests to the logical plan of the author's undertaking. He is unsparing, too, in painting the medical picture as it first existed at Poston under the self-government system, the quality of the nursing, the hospital equipment that didn't arrive, the complaints and the public health problems.

This book should be widely read. Dr. Leighton, who, by the way, with his wife is co-author of that fine study of Indian life, "The Navaho Door" (Harvard University Press, 1944), has had vast experience in the study of "assimilated" peoples. He writes with understanding and with art. "The Governing of Men" is not only an important and interesting study; it is also very well written. The book is sponsored by the American Council of the Institute of Pacific Relations.

TEXTBOOK OF ABNORMAL PSYCHOLOGY, by *Roy M. Dorcus*, Associate Professor of Psychology, University of California at Los Angeles; and *G. Wilson Shaffer*, Dean of the College of Arts and Sciences, Lecturer in Psychology, Professor of Health and Physical Education, Johns Hopkins University. 3d edition. 547 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1945. Price \$4.

This is the third, revised edition of a book which has been a leading text in its field for the past ten years. It is not written at a popular level, but is aimed deliberately at the advanced student. It is eclectic in its viewpoint, comprehensive in its coverage.

and thorough in its treatment of individual subjects. Its bibliography of 833 titles and its 547 pages of relatively small print attest to the scope of the volume.

The organization of the text is conventional, beginning with a treatment of sensory and motor disorders and then proceeding through the disturbances of central processes, emotion, sleep, dreams, and hypnosis. There follows a discussion of classificatory principles, and then a survey of the various classical neuropsychiatric syndromes, grouped as functional or organic. There is a thorough discussion of modern methods of "shock" therapy in the chapter on "Treatment by Physical and Chemical Assault." The book concludes with a long chapter on therapeutic principles and technics.

The eclectic viewpoint will be annoying to those proponents of the ruling "isms" in psychology and psychiatry. Moreover in a text as inclusive as this one there are bound to be many minor sins of commission and omission that will be noticed by the individual reader, depending upon his personal background and opinions. In general, however, the authors have done an excellent job in handling their material and their book merits a place on the reference shelves of any serious student of the subject. In these days, with the contacts that are developing between psychiatry and psychology, a comprehensive text such as this serves the further purpose of pointing out how much each science has contributed to our understanding of human behavior and how necessary it is for psychiatrist and psychologist to work together in approaching the many problems involved in personality disorder.

AN INTRODUCTION TO SOMATIC METHODS OF TREATMENT IN PSYCHIATRY, by *William Sargant, M.A., M.B. (Cantab.), M.R.C.P., D.P.M., Medical Officer, Maudsley Hospital, London, England; and Eliot Slater, M.A., M.D. (Cantab.), M.R.C.P., D.P.M., Medical Officer, Maudsley Hospital, London, England.* 171 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price \$2.50.

This is a compact little volume which should be extremely valuable to men who are new to psychiatry. It contains very little which has not already appeared in the literature, but it is one of the few volumes which treats entirely the therapy of the psychoses. The approach is eclectic and the attitude of the authors is quite broad. They believe that we should be careful lest in our psychologic approach to the psychoses we neglect the possibilities offered by physical treatment. Even though physical treatments are purely empiric, nevertheless they are of great value, for they aid in reducing the number of days spent in mental hospitals and

assist the patient while he is going through the devastating experience of a protracted mental illness.

The authors state that even though one may be sure that the melancholic patient has a 95 percent chance of making a satisfactory recovery eventually, that is no excuse for not seeking to reduce the number of sick days to a minimum. If illnesses tend to drift toward chronicity, they feel it incumbent upon the psychiatrists to consider more radical and drastic treatment methods than the usual expected care. They discuss the uses and the difficulties of insulin and shock therapy, the use of chemical sedation and stimulation, and the various forms of continuous sleep treatment.

In all it is a hopeful little book and it shows that treatment in psychiatry has come a long way in the past ten years. There are many pungent paragraphs which are quite valuable. To mention but a few:

"To attend to the neurotic aspects of bodily disorders which constantly face the physician and the surgeon, we do not need more psychiatrists. We need rather a wider diffusion of the psychiatric attitude and of psychiatric knowledge among the general medical public."

"Psychosomatic medicine will do itself no good if it takes yet more patients from the general medical attack."

And again, "The best guide to a fair judgment of a man's capabilities is gained from his own past history and not from a comparison of his present state with that of a 'normal individual'."

The book is recommended for all new psychiatrists, particularly those who have had their introduction to psychiatry since joining the military service.

ANATOMY AND PHYSIOLOGY FOR STUDENTS OF PHYSIOTHERAPY, OCCUPATIONAL THERAPY AND GYMNASTICS, by C. F. V. Smout, M.D., M.R.C.S., L.R.C.P., *Senior Lecturer and Acting Professor, Department of Anatomy, University of Birmingham*; and R. J. S. McDowell, M.D., D.Sc., *Professor of Physiology, University of London, King's College*. 418 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price \$8.

The scope of this volume is adequate for the groups for which it is intended. It goes far enough into the individual field to provide a good basic working knowledge of the subject, yet does not tend to go into unnecessary detail. There is a definitely "functional" approach and all material is fitted together to enable the reader to comprehend the interrelationship between the various individual subjects.

The style of presentation is clear, brief, and yet adequate. The illustrations throughout seem to be well chosen and simplified so

that the average student will have little trouble identifying structures. Particularly valuable for this volume is the "living anatomy." Too few texts have adequate sections on this material. There is a great need for additional emphasis on this type of work.

The material on muscle work in some common movements is also quite valuable. It gives a basis for further study along the same line.

The discussion and exposition of the arches of the feet is one of the best this reviewer has seen. It is different from many others, and some may disagree violently, but it seems well founded.

This volume could well be in the library of all schools of physical therapy and occupational therapy, as well as schools of physical education. As a textbook for students it should fill a distinct place. Medical officers interested in the physical phases of rehabilitation may find it a handy, quick review volume for some problems in this field.

APPROVED LABORATORY TECHNIC, Clinical Pathological, Bacteriological, Mycological, Virological, Parasitological, Serological, Biochemical, and Histological, by *John A. Kolmer, M.S., M.D., Dr.P.H., Sc.D., LL.D., L.H.D., F.A.C.P., Professor of Medicine in the School of Medicine and the School of Dentistry, Temple University; and Fred Boerner, V.M.D., Associate Professor of Clinical Bacteriology, Graduate School of Medicine and Assistant Professor of Bacteriology, School of Medicine, University of Pennsylvania.* 4th edition. 1017 pages; illustrated. D. Appleton-Century Co., New York, publishers, 1945. Price \$10.

This book is an improvement over Kolmer's previous book. It is a good reference book, but does not include sufficient detail about each list to make it outstanding despite the rather encyclopedic general effort. It would be inadequate if one were working in an isolated place with only one book available. It is strictly a technicians' manual, making no attempt at clinical interpretation and only briefly mentioning the conditions in which certain laboratory findings are significant. (As mentioned in the preface, Kolmer is author of another book, *Clinical Diagnosis by Laboratory Methods*, which supplements this book.) There is an impressive list of thirty collaborators.

The type is large, clear and easily read. It is profusely illustrated by figures and photographs. Tables are numerous. Colored plates are not as numerous as in some. Heavy border lines around most of the photographs and tables give the book balance but also a slightly unpleasing geometric effect. The book is as reasonably up to date as can be expected of any book, considering advances that may have been made in the various fields of laboratory work after preparation for printing. For instance certain recent ad-

vances have been made in Rh typing, notably a heavier cell suspension to do away with blocking action, which is not described in the book. It is notably free of typographic errors throughout most of its 958 pages of subject matter.

As would be expected the section on serology is especially good, describing in detail the latest accepted serologic methods. The Kolmer complement fixation tests include a description of the "one-half method" and also a new scheme for reporting quantitative reaction in Kolmer units. Typographic errors in tables 41 and 42 may be confusing. Inclusion of a pathology section is unusual, and it is especially good in describing in detail autopsy technic and the preparation of specimens.

The latest methods are covered and there is hardly a test in which at least two procedures are not described, even to how material is procured. Such new things as vitamin assays, blood plasma preparation, tests for penicillin, etc., are fully described. The toxicologic section is more complete than that usually found in general laboratory manuals. For doing thick smears in malaria, this book would be of little help, but the remainder of the parasitology section is very good.

It is most highly recommended as a general reference book on clinical laboratory procedures, and has long been in daily use as such at the Naval Medical School.

MEDICAL DISEASES OF WAR, by Sir Arthur Hurst, M.A., D.M., F.R.C.P., Lieutenant Colonel, Late R.A.M.C.; with the co-operation of 7 prominent contributors. 511 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., 1944. Price \$6.

This book on military medicine is a product of the British. The first edition was published in 1916, the present being the fifth edition. There are eight contributing authors, all of whom write with that easy, lucid style characteristic of British medical authors. The illustrations are few but appear well chosen. Two-fifths of the book is devoted to functional nervous disorders, and the remainder to the more commonly encountered medical diseases in the field. There are chapters on typhus, the dysenteries, epidemic jaundice, malaria, meningococcic meningitis, skin diseases, and gas poisoning. Individual chapters are well organized with no overlapping of subject matter as is so frequently seen when different chapters are written by different authors.

As the reviewer sees it, the chief value of the book lies in the chapters on functional nervous disorders, written by the senior author, Sir Arthur Hurst. He has drawn from his long experience in this field and presents many vivid case histories of the various disorders. The chapters on hysteria, effort syndrome, and neur-

asthenia especially show keen insight in analysis and diagnosis, and real wisdom in therapy. Scattered through these chapters are pithy remarks, short phrases or single words that get right to the kernel of the nut and are likely to sink permanently into the reader's mind.

The remainder of the book, the reviewer thinks, is not up to this standard. The subjects covered are better treated in works on tropical diseases, textbooks of medicine, and certainly in this country in the various field manuals available in the armed services.

PEDIATRIC NURSING, by *Abraham Levinson, B.S., M.D., Associate Professor of Pediatrics, Northwestern University Medical School*. 3d edition, rewritten and reset. 299 pages; illustrated with 53 engravings and a colored plate. Lea & Febiger, Philadelphia, Pa., publishers, 1945. Price \$3.

This book is a good book on pediatrics by an experienced pediatrician.

The material suggested in "A Curriculum Guide for Schools of Nursing" is all included. The beginning chapters on growth and development and the care of the well child, and the concluding chapters on the psychologic and sociologic aspects of child nursing seem particularly helpful. Many student nurses have no concept of what a child should be able to do or how he will probably react in a given situation. Help is also given in understanding the reactions of the relatives to the sick child and how best to cope with them.

The important diseases of children are adequately covered and should give the nurse a working knowledge of them. It would appear that most of the principles and practices in the nursing care of these diseases are to be learned from some other source.

This is a very readable book. While it is primarily designed for use in schools of nursing, it will probably be extensively used on the dependents' wards in Naval hospitals as a source of review by members of the Nurse Corps, and for instruction of Hospital Corps WAVES.

STATE BOARD QUESTIONS AND ANSWERS FOR NURSES, Essay and Objective Types, Compiled from Actual Examination Questions Given Throughout the Country by State Examining Boards, by an *Editorial Panel of 11 Authorities in Nursing Education*. 23d edition, 1945, revision, 1159 pages, J. B. Lippincott Company, Philadelphia, Pa., publishers, 1945. Price \$3.50.

This book is designed primarily, as the title indicates, to assist students preparing to take State Board Examinations. If the student will read carefully and then follow the suggestions of Sister M. Berenice given in the preface, this aim may perhaps be

accomplished. Too often the student buys a State Board book, forgets that she has any texts or notes, and sits down to memorize the answers prepared for her. This is particularly encouraged by a book in which the question is immediately followed by the answer as it is in this one.

The questions and answers in this book have been recently reviewed in the light of the latest scientific developments. It seems that some controversial material remains, as "inherited" syphilis, and giving a 5-months-old baby $2\frac{1}{2}$ ounces of carbohydrates in the formula.

Although it may never have been so intended, this book is often used by teachers in nursing schools as an aid in preparing examinations. For this reason I believe the principles involved in constructing good tests should be considered more carefully. Two examples of the violation of these principles are: (1) The use of key words in True - False questions, such as only and never; (2) an equal number of words and definitions in the Matching questions. Exceptions to this latter are the questions on obstetric nursing and history of nursing which are very well done.

I see no reason why this book should be placed in the libraries of Naval hospitals, not even those in which cadet nurses receive the last 6 months of their training.

MEDICAL GYNECOLOGY, by James C. Janney, M.C., F.A.C.S., Assistant Professor of Gynecology, Boston University School of Medicine. 389 pages; illustrated. W. B. Saunders Company, Philadelphia, Pa., publishers, 1945. Price \$5.

The book presents a novel conception in evaluating the differential points in the history and physical examination, and arriving at a diagnosis and indicated treatment for each condition. It is a very good guide in the thinking necessary to a logical and satisfactory approach to gynecologic problems.

Most practitioners are familiar with the contents of this book, and the subject matter is presented in a fashion which is a little too deep for the lay person and a little too light and incomplete for the practitioner. The presentation is lacking in practical details of the technics and methods of treatment, thereby losing practical value for the practitioner.

The style and tone of the book are good. It is very readable, holds interest, and is not laborious or fatiguing. Most of the illustrations and charts are good but insufficient. Moreover some are antiquated, such as the illustration on page 23 depicting the Sims position.

The bibliography is excellent; however instead of using this he falls back on his own broad individual clinical experience.

There is a departure from gynecology in discussing in detail socio-medical problems, in which he expounds from his own experience. The discussion of the problems of sterilization, contraception, and birth control should have been confined to a discussion rather than to an attempt by the author in several instances to apply his own standards of morality. Statements such as "It is frequently the doctor's duty, in safeguarding the life or health of a patient, to recommend contraception to patients who are opposed to it because of religious considerations," are not acceptable.

A more detailed review of the menstrual cycle would result in a better orientation and more understanding of the underlying reasons in prescribing endocrine therapy.

Notwithstanding the above-mentioned adverse criticisms, the volume is a foundational stepping-stone for further study and reading. This, and the author's evaluation of differential points in the history and physical examination in arriving at diagnoses and treatments, giving a new addition to gynecologic literature which will be found as a refreshing survey.

CLINICAL CASE-TAKING, Guides for the Study of Patients, History-Taking and Physical Examination or Semiology of Disease in the Various Systems, by *George R. Herrmann, M.D., Ph.D., Professor of Medicine, University of Texas.* 3d edition. 192 pages. The C. V. Mosby Co., St. Louis, Mo., publishers, 1945. Price \$1.75.

This is a most useful little book, which seems primarily designed to meet the needs of the medical student in his approach to clinical medicine. The author presents the essentials of history taking and physical examination in a complete and sound fashion. The emphasis placed on the importance of an exacting, complete and intelligent history is most stimulating. Plan of organization and manner of presentation is quite logical.

For completeness' sake, it would be well to add a section on pediatrics to this volume. One error of content is noted on page 160 in the definition given of the Argyll-Robertson pupil, which reacts normally to accommodation, but fails to react to light.

The section on neuropsychiatry, particularly the outline for mental examination, is very good and should be mastered, as psychiatric problems play a large part in all types of illnesses.



TRANSPORT OF ANTIGEN BY ELECTROPHORESIS

Horse dander, cottonseed, ragweed, and peanut antigens were not only introduced into the skin by electrophoresis, but were also transported through the body by the same means. By electrophoresis, the antigens were transported through three subjects in the same circuit. Electrically-transported antigen was not present in the circulation but moved directly in an electrically charged state along the path of the electric current from the positive to the negative pole.—WALZER, A., and GOLAN, H. G.: Transport of antigen through the body by electrophoresis. *J. Allergy* 16: 165-175, July 1945.



ORAL AMINO ACIDS IN BLEEDING PEPTIC ULCER

Eleven patients suffering a severe hemorrhage from peptic ulcer were treated with the usual Sippy diet to which was added a daily oral intake of from 100 to 200 gm. of a mixture of amino acids. The serum protein returned to normal, on the average, within 10.2 days. In a control group of 6 patients who were given the same Sippy diet but without the addition of the amino acids, the serum protein returned to normal, on an average, after 19 days.—LEVY, J. S.: Effect of oral administration of "amino acids" on the hypoproteinemia resulting from bleeding peptic ulcer; preliminary report. *Gastroenterology* 4: 375-387, August 3, 1945.



SODIUM BICARBONATE IN PNEUMONIA

Experimentation with rats has shown that sodium bicarbonate exerts a deleterious action in pneumonia. This effect can be seen in the rats receiving only sodium bicarbonate, but is more clearly seen in those receiving the combination of sulfadiazine and sodium bicarbonate. We have no experimental evidence, as yet, to offer as an explanation for this phenomenon.—LOUGHLIN, E. H.; BENNETT, R. H.; WOLF, J.; and FLANAGAN, M. E.: Treatment of experimentally induced type I pneumococcus pneumonia in albino rats; a comparative study of treatment of pneumonia with sulfadiazine alone and in combination with sodium bicarbonate. *J. Lab. & Clin. Med.* 30: 695-700, August 1945.

PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge

VENEREAL DISEASE DISCIPLINE

**FUNCTIONS AND PROBLEMS OF EDUCATIONAL
PROPHYLAXIS IN THE U. S. NAVY**

**HOWARD W. ENNES, JR.
Lieutenant H(S) U.S.N.R.**

The educational prophylaxis of venereal disease has as its primary objective the reduction of venereal casualties to a minimum. As such, its point of emphasis is the individual, and its aims are to establish within the individual a desire (a) to avoid exposure, (b) to protect against infection, and (c) to seek proper medical care if infected.

In such simple terms it would seem that the Navy could operate quite independently. Except in a very strict sense this is not the case. While the final expression of educational activity does take place almost completely within the Naval service, the development and administration of educational efforts must take into account a number of fundamental limitations which have their roots outside of the Navy. The most important of these conditioning factors are: (1) That the great bulk of the Navy today is made up of civilians who retain many of their civilian ways of thinking, many of their civilian habits, and who expect to return to civilian life; (2) that prior to their entry into the Naval service they have accumulated a substantial amount of information, good or bad, as to sex hygiene and venereal disease, and within wide ranges their habits of (or at least their attitudes toward) sexual behavior have been established; and (3) that as sailors and Marines, venereal disease exposures take place and infections are acquired in civilian communities.

This latter point deserves emphasis: At the critical moment, i.e., when the man decides for or against exposure, for or against prophylaxis, the Navy has no formal, direct control over his actions. Venereal disease discipline, so to speak, exists only within the man himself, a reflection of previous experience and information. The Navy can neither successfully forbid exposure nor order the use of prophylaxis.

THE VENEREAL DISEASE EDUCATION PROCESS IN THE U.S. NAVY

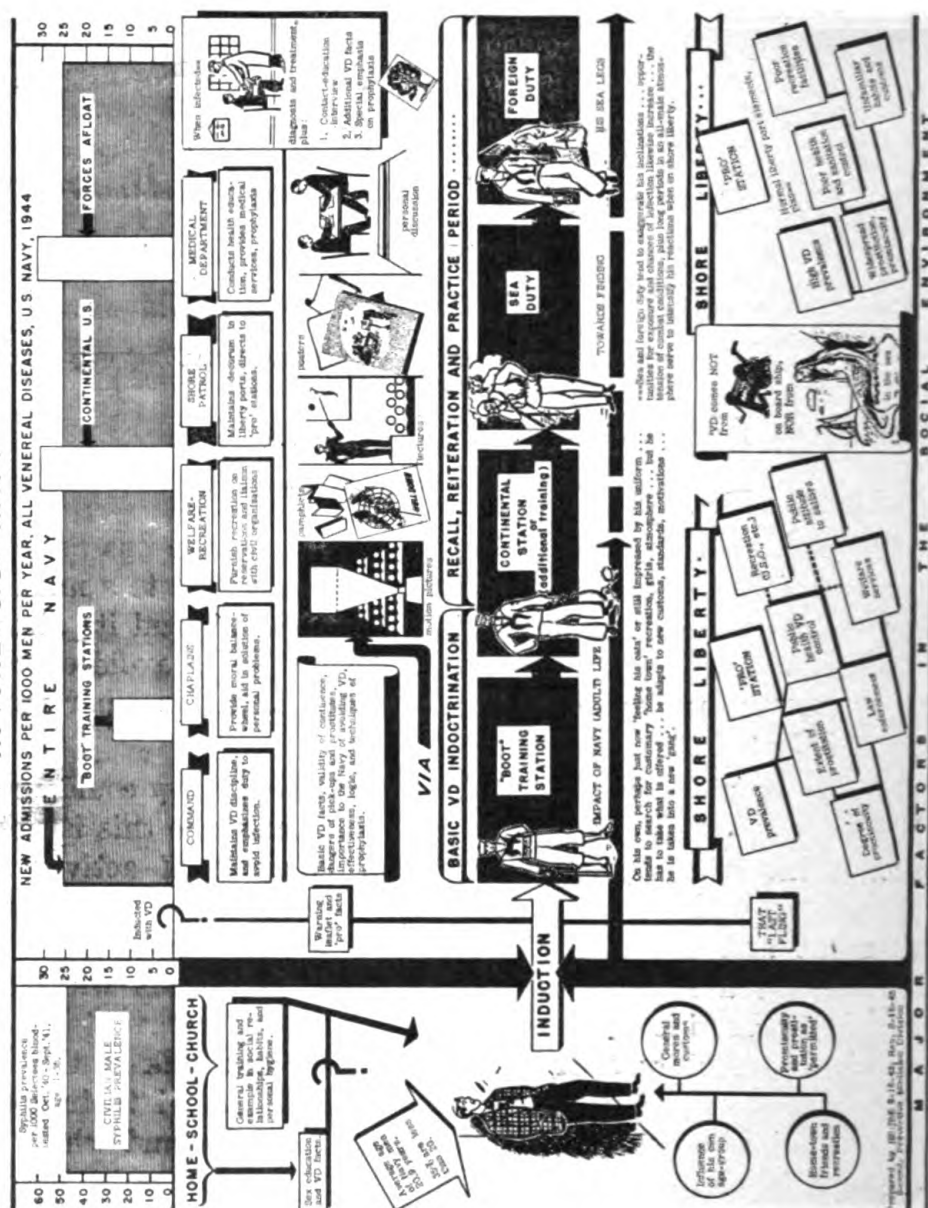


Figure 1.

ENVIRONMENTAL SYNDROME

In figure 1 an attempt is made to project graphically the admittedly complex and numerous elements which bear upon the sailor and Marine and which materially condition his actions and the efforts of Naval and civilian authorities to protect him from venereal disease.

The key element, of course, is the man himself. He is pictured in the center panel as the civilian youth who passes through the Selective Service induction process to become a recruit in the basic training station. He may then be transferred to active duty

or further training at a continental shore station, or he may go to sea duty or foreign duty ashore.

It becomes apparent that study of this "typical" boy-become-sailor or Marine cannot be without prime consideration of the time factor. The uppermost section of the chart suggests this relationship in terms of disease rates. The prevalence of syphilis is impressive among selectee age-groups, is thinned out substantially in the induction mechanism or is brought under treatment in the early days of Naval service. But thereafter the all-venereal disease incidence rate begins slowly to be built up. And as the ultimate objective of the new Navy man is reached, i.e., sea and foreign duty, the peak of venereal incidence is also approached.¹ Such a charting serves to highlight points of emphasis.

The remainder of the chart may now be considered as describing two main elements in the venereal disease syndrome: (1) The major factors in the social environment; (2) efforts to inform and guide our "typical" subject, and by whom.

Across the lower portion are indicated the leading environmental elements. The general customs and mores of his community, the practices of his own gang, the deepness of his feeling of "belonging"—all enter into the background of our composite youth. In general it may be said that the lad in civies is subject, at present, to less exploitation but also to less constructive attention than the man in uniform—a fact which no doubt bears on current juvenile delinquency difficulties.

With his 1-A card and certificate of fitness, however, begins a transformation (and transmutation, in some respects) marked by one or a series of "last flings," unfortunately too frequently of venereal disease significance. He begins to absorb the impact of a reasonably adult Navy life during "boot" training, follows it up (generally) with a furlough back home; then to a continental station for active duty or further training.

It is here that our "typical" new sailor comes into first, direct contact with community conditions predisposing either to "good times in good company" or sordidness and venereal disease. Here he finds "pro" does not stand for the kind of professional he may have thought. It is here that community venereal disease control and recreational facilities, the level of sexual mores, and public attitudes toward service personnel play their crucial roles.

While he is finding his sea legs aboard a pitching destroyer, a waddling LST, or a lumbering battlewagon, he finds time also to dream and to discover that wearisome days of convoying and

¹ Caution should be exercised not to compare directly the syphilis prevalence figures with the incidence of all venereal disease.

cruising build up a tremendous urge for liberty—for release from the confines of his ship, for different food, for the companionship of the nearest approximation of a Varga girl. So when he hits the beach it is largely what is within him as the result of his background and constant drumming of the Navy system that maintains his balance in the midst of generally unfavorable environmental circumstances.

CONTROL CONSTANT

Such a multitude of widely variable factors appears to offer little upon which a sound educational endeavor could be based. For example, it is true that an increasing number of public schools and agencies are attempting to provide sound hygienic instruction for youth. As a nation, however, we have failed miserably to prepare future parents for adult living. The ignorance and misinformation of the average 'teen-age youth, even of presumably more mature adults, borders on the tragic.

Again it is true that in the United States the more obvious obstacles to venereal disease control have been removed, at least temporarily, by the relatively successful prostitution repression effort. Such is not the case abroad. And even in this country the promiscuous "victory girl" continues to spread venereal disease and to raise significant social and morale difficulties both for the Navy and for the civilian community.

It becomes obvious that if there is a constant which might be utilized in the prevention of venereal disease, it must be found within the Naval service. Such a constant appears to exist, paradoxically, in the person of the Navy man himself. This is not to assume mistakenly that when a man (or woman) dons Navy blue he sheds the influence of past experience and becomes a totally different individual. It is merely to say that within the Naval service we do possess some measure of conditioning-control over our personnel.

Direct, overt, and individualized application of the broader aspects of education—the so-called "moral prophylaxis"—is generally considered to be almost precluded by the pressure of time and military necessity. Moreover lest such efforts turn in upon themselves, a high order of caution is exercised even in such application as circumstances may permit. Boone (1) has pointed out that "any effort to influence his (the sailor's) behavior while on liberty must be circuitous, indirect, made at long range, unrecognized by him, made with infinite tact and complete comprehension of the man's tastes, strength, and weakness." Navy life in general, however, is not without a broadening and strengthening influence

upon the character of any man who is capable of appreciating basic realities and of adjusting himself maturely in an adult environment.

Thus if there is added to these basic circumstances a conscious and specific endeavor to inform, it follows that there would tend to be established a level of information and action on the part of the individual which, added to a reasonably high degree of environmental control, should provide substantial protection against infection. We would be striving, as it were, to raise the threshold of the individual's inner barriers to unhealthy conduct.

IMMEDIATE PROBLEM

Venereal disease in the Navy, unfortunately, is not a potential but an immediate problem (with, needless to say, a considerable future). Educational prophylaxis is consequently faced with a wide variety of day-to-day problems which must be met in a substantially specific and practical fashion, and which, in the main, must be met by medical officers (2).

In considering how to meet these problems it must be kept in the fore of our thinking that the sailor, Marine, or WAVE—as an individual—is the key element. Circumstances, on the other hand, dictate that much of the educational approach must be in a mass fashion, and we are immediately faced with a problem of balance. Our bearings can be maintained reasonably well by understanding that while current educational technics are, in general, of a mass character, their content and motivation are essentially individual, i.e., a pamphlet is directed to and read by *one* person only and a motion picture film, though shown to a group, is in reality only seen by *one* person.

COMPONENTS OF VENEREAL DISEASE DISCIPLINE

Since the individual is the key to our problem and the object of our efforts, it is pertinent that we understand at least the major factors which influence his conduct and which tend to pull him toward or push him away from venereal disease exposure and infection. An individual's venereal disease discipline might be said to encompass immediately the following elements:

1. Amount of information and misinformation about venereal disease and related matters.
2. Degree of understanding of the implications of these facts in terms of himself and his service.
3. General personal habits and ethical standards.
4. Extent of factual information about prostitution and promiscuity in general, and his personal evaluation.

5. Social pressures of his own in-group.
6. Environmental pressures during liberty.
7. Degree of conviction as to the efficacy of prophylaxis and his willingness to utilize such measures.
8. Practical ability to use prophylaxis properly.
9. Evaluation of the danger of venereal disease versus exposure as related to his total personal situation.

Any adequate consideration of these factors would require substantially more attention than is possible here. Admitting its limitations, a brief dogmatic statement will be given for each.

1. The adequacy of information appears to vary considerably in relationship to intellectual level and educational opportunities, age, and experience. Reliable data are meager and research is sorely needed. Empiric judgment clearly suggests, however, that while a high level of venereal disease information may or may not tend to reduce infections, a low level of information definitely sets up barriers to adequate control.

2. The degree to which the facts of venereal disease are understood and their implications appreciated by the men in the Navy service is difficult to measure. Experience suggests that the physical implications are reasonably well understood, but to the extent that reliance is placed upon the fear of disease, a control program is leaning upon a demonstrably weak psychologic reed. It is altogether possible that the broader implications of venereal disease, in terms of ethics and mental hygiene, are more widely appreciated than articulated, although the difficulties in capitalizing upon such tendencies in practical control practices are manifest.

3. The Navy man or woman is rather much the typical American, in so far as his or her ethical standards and personal habits of sexual adjustment are concerned. Such habits, formed previously or in process of formation, are most significantly influenced by background. Conditions in the Naval service may very well provide the final stimulus to pro-venereal disease actions, but by and large, it is generally agreed, the antecedents of such behavior have their roots in one's past.

4. The extent and reliability of information and attitudes toward prostitution and promiscuity, as in the case of venereal disease information, reflect largely the individual's experience and background. It is the generally accepted opinion that he is poorly informed as to the scientific facts about prostitution and prostitutes and the practical results of the several "control" methods. Gallup polls of 1942-43, indicating that roughly 60 percent of American men favored regular medical examination of prostitutes,

very probably reflect Naval opinion as well as they do civilian.

5. Social pressures of his own "in-group"—the "gang" influence—in the armed services, in the nature of things is more prominent than generally pertains in civilian life. This appears both as a positive and negative factor important to venereal disease control, and presumably is measured to some degree by that intangible, morale.

6. The significant influence of environmental pressures under liberty conditions has been suggested. Clearly these play a critical role in the formation and maintenance of venereal disease discipline.

7. Quantitative data concerning the degree of individual conviction as to the efficacy of prophylaxis is meager. It would appear, however, that the enlisted man, although not appreciating the medical nuances of the matter, apparently holds as many reservations as does the medical officer.

8. Practical ability to use prophylaxis properly is undoubtedly subordinate to the desire to do so. Reports of infected Navy personnel show that a minimum of 70 percent admit to using no prophylaxis whatever. The remaining 30 percent is made up of frank failures as well as improper usage, including such curious forms of prophylaxis as a shower the next morning or an alcohol douche.

9. To speak of the sailor's personal evaluation of venereal disease exposure as related to his total situation is to consider a highly complex range of motivations and pressures about which, scientifically, we know all too little. The emotional implications of war life, and the action patterns which result, are not subject to simple, straight-line controls, yet a practical understanding of these implications, and their results, is necessary to effective venereal disease control. One concrete fact is suggested by preliminary results of studies now in progress which show that approximately 40 percent of Navy personnel display rather definite patterns of extramarital sexual relations.

DEFENSE IN DEPTH

The basic venereal disease control policy of the U. S. Navy is essentially a defense in depth. The strategy aims first at avoiding exposure. That failing in a certain proportion of cases, protection against infection is brought into play. Finally personnel who infiltrate through these lines and become infected are subjected to diagnostic and treatment procedures.

Navy organization for venereal disease control is total, extend-

Secretary of the Navy

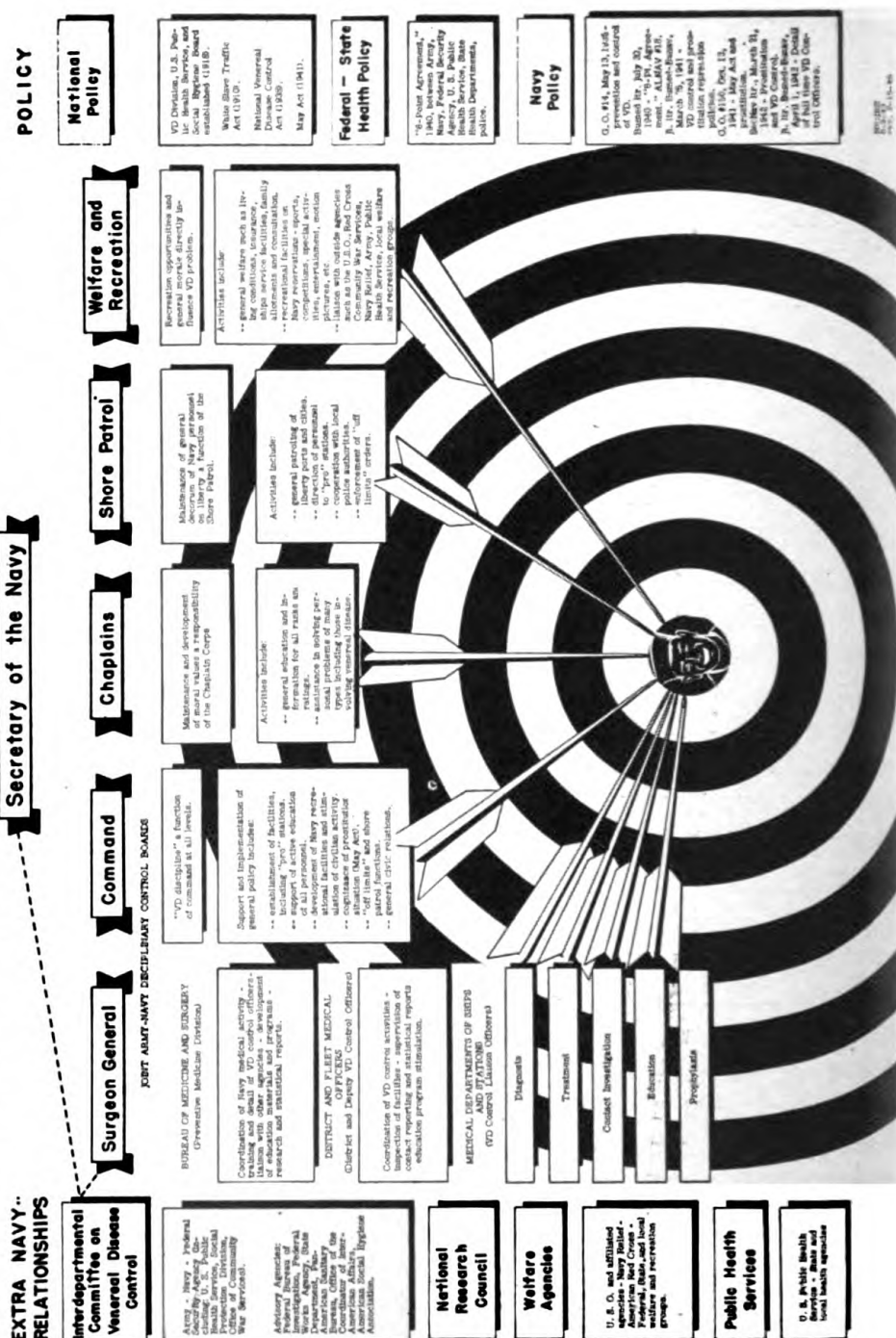


Figure 2.

ing from top to bottom and flank to flank. As suggested in figure 2, the entire focus is upon the fighting man as a whole human being.

Within this framework, and to the several elements of venereal disease discipline, medical venereal disease education must address itself—with, unfortunately, too little “scientific” fact to go on.

Avoid exposure.—The first reaction of the average medical officer is, “leave it to the chaplains.” But the matter is more than morals, and can be worsened by moralism. It is more than mere physiologic or medical fact. It is a question, to use Navy terms, of morale as a whole—of the individual’s harmony with his environment in his day-to-day activities. Involved is the whole range of recreation and entertainment, of every man’s understanding of himself and his emotional, physical, and social future. Every officer—indeed, every man and woman—helps or hinders the development of a cohesive morale, but the Medical Department bears unique responsibilities.

There is first a factual foundation to be established or revised. A prominent misconception among younger men, for example, is that sexual exercise is necessary for manliness. The complete compatability of continence and health needs underscoring. Information about venereal disease is presented as a matter of basic information which should be held by every adult.

The intimate link between venereal disease, prostitution and promiscuity must be demonstrated, and a common-sense point of view developed. In the Navy, particularly, the tradition of acceptance of regulation and segregation has a long and even “honorable” history. In the light of current contact reports, indicating less than 6 percent of infections (in the United States) are from women to whom a fee is paid, it is imperative that every man thoroughly understand the implications of the “easy-to-get” girl. Again looms the pitfall of confusing disease and conduct standards. Perhaps the emphasis should be along the line that “whether or not it happens to result in venereal disease, indiscriminate sexual behavior in adult life is a sign of immaturity.”

Protect against infection.—When efforts to prevent exposure have failed, we must fall back upon the second line of defense, prophylaxis. Since it is unpredictable which men will infiltrate to this point, the entire group must of necessity be instructed.

The educational problems involved are three: (1) To convince of the necessity and reliability; (2) to teach proper technics; and (3) to develop what amounts to a habit of utilizing prophylaxis at the crucial time. Particularly under foreign conditions it would

appear that there is no more important task than that of promoting the proper and timely use of prophylaxis. The approach at this stage can hardly be a compromising one. After all, prophylaxis is a very common-sense proposition, particularly so far as the condom is concerned. It is simply, so to speak, a matter of shutting the barn door before the horse is stolen.

If the men can be brought to understand the chance of germs being present and can reasonably balance this against the degree of protection afforded by the condom and chemicals, we are probably safe in feeling that even under extreme conditions the normal man will tend to react sanely. This is not to minimize the many intangibles involved. We can only hope to reach a sufficiently high percentage to bring unprotected exposures to a controllable level.

The charge has frequently been leveled that "prophylaxis promotes promiscuity"—an assertion that is at best debatable. Indeed the man with a prophylactic in his pocket carries with him a constant reminder of the very real dangers venereal disease represents. Another parenthetical but hardly incidental or unimportant point is involved in prophylaxis instruction. This is the importance of the person's knowing with whom he is exposed so that if infection is acquired, contact investigation can be instituted promptly.

Treat disease.—When exposure has not been avoided and infection has resulted, either from unprotected exposure or prophylactic failure, treatment machinery enters the picture. Many assume that Naval circumstances assure the prompt reporting for treatment of all cases. And it is true that most obstacles have been removed, including only recently the pay and time loss penalties, as well as the misconduct entries. There remain, however, restrictions upon advancement of certain personnel, and every civilian-turned-sailor has not shed all of his taboos. Concealment and self-treatment are factors, if undetermined in extent. Continued emphasis is required as to the importance of promptly applying to the medical officer at the earliest symptom. Willful concealment must be considered a serious offense prejudicial to good order.

The fact of venereal disease infection must be looked upon as *prima facie* evidence of a failure of the control program in general, and of the educational process in particular so far as the infected individual is concerned. Each patient must thereby become subject to a re-education process which clarifies the essential facts, stresses again the practical importance of avoiding future exposure, and highlights the imperative necessity of better, more prompt prophylaxis when exposure does take place.

Treatment circumstances offer an unparalleled opportunity for this re-education, especially when coupled with the contact-education interview (3). For it is here that a private, face-to-face conversation is not only possible but practicable between the patient and the medical officer or his representative. In point of fact, the contact-education interview occurs at a most critical juncture in the total control picture. Action by civilian health departments based upon accurate information as to the identity of contacts of Naval venereal disease patients offers the most direct means available of reducing the source of further infections to other Navy personnel.

APPROACHES TO VENEREAL DISEASE EDUCATION

Limitations of what has passed as venereal disease education in the past are obvious to even the untrained eye. It is presumptuous, for example, to dignify the occasional lecture by calling it an "educational process" and expecting it to produce practical results. This is not to belittle the medical officer's efforts, but to emphasize that effective education is a continuing process, and that the single lecture, given under the usual conditions, is foredoomed to failure. The infrequent lecture must fall down, among other reasons, because too much is attempted at one time—a question, simply, of too many eggs in one basket. At the other extreme, the repetitious use of one or two basic motion pictures serves not to impress the facts so much as it does to irritate and suggest that the subject is of little importance because of its careless presentation.

More generally the limitations of venereal disease education as it has been widely practiced include: (1) Failure to appreciate that the problem is broad and deep in its implications, and that attempts to modify human habit-tendencies involve the entire person; (2) persistence in attempting to classify all persons into clear-cut stereotypes as to sexual ethics and habits; (3) laxity in consciously planning the course of the educational process and enlisting the active support of all elements, from line and commanding officers to chaplains; (4) general reliance upon one or two communication devices—most frequently the lecture or the motion picture—and a tendency to speak of venereal disease to the layman either in a language and form appropriate to medical personnel and thereby completely outside of the sphere of recognition of the common layman, or, on the other hand, to "talk down" to the audience, with the result that even purposes of objectivity are frequently overshadowed by an impression of superficiality and insincerity.

Taking these factors into account, the venereal disease education process as it is presently being shaped in the Medical Department of the Navy operates at five levels. *First* there takes place at recruit training activities a relatively formal and organized education. This is directed toward basic orientation and information, and consists principally of primary lectures by medical officers supported by the line and chaplains; showing of the basic "Sex Hygiene" film; distribution at roughly weekly intervals of the Bumed-prepared series of six leaflets (see fig. 3). This begins with a leaflet on physiologic essentials and on the meaning of sex and concludes with a booklet summarizing venereal disease facts, emphasizing continence, and outlining prophylaxis technics.



3. Bumed VD leaflets. Upper row, left to right: Navmed 377 (VD-2), basic sex hygiene; Navmed 378 (VD-3), syphilis; Navmed 379 (VD-4), gonorrhea. Lower row, left to right: Navmed 380 (VD-5), "minor" venereal diseases; Navmed 383 (VD-8), VD overseas; Navmed 381 (VD-6), prophylaxis.

Second comes an informal education level where reiteration and recall of previously learned facts are presented with a view to shaping motivations and conditioning actions. For the Navy as a whole, Bummed-prepared posters, issued monthly, are prominently



4. Bummed VD posters produced in cooperation with the U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md. Upper left, VP-16; upper right, VP-12; lower left, VP-9; lower right, VP-13.



5. Burned poster VP-4 (left) is directed toward preventing repeat infections in

utilized (see figs. 4 and 5). When posted in strategic locations (as for example in ship's service stores, barracks, recreation spaces) these materials have proved effective in attracting attention and, apparently, in transmitting their messages. Also with the object of reiteration and motivation, a series of short "entertainment" type motion pictures prepared by Bumad for use during regular film showings. Leaflets to provide new emphasis on important basic points are now in preparation.

At the *third* level there comes into operation a relatively formal and organized re-education process which takes place aboard all ships and at all stations. Methods of presentation are similar to the basic orientation, featuring lectures by medical officers and showings of motion pictures. For the latter the basic fact-film is replaced by several other Navy-made or otherwise produced films (see list on page 1014). These films and lectures review basic data with new approaches and emphasis.

The *fourth* level has to do with special groups, notably line and other staff personnel who hold key positions with respect to the development and maintenance of venereal disease discipline. Approaches in this field must of necessity be adapted to the circumstances. Lectures and discussion groups with officers and petty officers have proved successful in providing new insight into a field replete with misconceptions and misdirected efforts. Motion pictures used for informational purposes with other groups also provide a basis for better understanding of the basic control and administrative problems involved.

The *fifth* level of education deals directly with the venereal disease patient. It bears repeating that the patient represents an educational failure on two counts: Failure to orient him toward continence, and failure to make effective the second (prophylaxis) line of defense. The re-education process undertaken with the patient focuses upon a reinforcement of his factual knowledge and attitudes toward venereal disease and aims at preventing repeat infections. Such re-education may be accomplished to some degree by group discussion. But the contact-education interview (3) offers the greatest likelihood of success. Here a man-to-man, down-to-bedrock conversation is possible. A variety of visual aids may be utilized to drive home the facts for the particular individual.

SPECIAL PROBLEMS

This five-decked structure has been erected to provide the mechanisms for coping with at least the major problems of Navy venereal disease education. It would appear sufficiently flexible

to be adapted as well to many of the special problems which arise in this field. Among these latter, four are outlined here because they are the very essence of the problem of venereal disease control today and require for their solution the combined consideration of all concerned.

Infections overseas.—Traditionally the Navy's higher rates of infection have stemmed from ships and forces overseas, with the peak of prewar morbidity being recorded in the Asiatic-Pacific areas. Forces-afloat rates during the war were relatively high (roughly 22 percent above the Navy average), but were declining in the latter months of the conflict. This reduction was very probably a direct reflection of limitations on opportunity for exposure.

As our forces moved farther east and positions consolidated, increasingly greater problems, of course, developed. Opportunities for exposures are increasing. Release from active combat conditions results as well in release of many protective inhibitions. High prevalence of infection with little or no public health control makes for a high venereal disease potential. Strange moral and social conditions add to the confusion. Economic pressures among natives, coupled in many areas with widespread prostitution, set up further obstacles to the maintenance of venereal disease discipline. To a considerable extent the nature of, and the forces making for, these problems can be anticipated. The question at point deals with the character of the administrative and educational methods, and when, where, and how they will be instituted.

The Negro.—Navy experience with respect to the level of venereal disease infections among Negro personnel does not differ significantly from civilian impressions. As Schwartz has said (4): "Rates are higher in men who lack a sense of security as to their place in life, in their unit, and in the Navy." The high rate of infection and the proportion of the total morbidity which is credited to the Negro serviceman pushes him into the category of a special control problem.

It is manifest that the Negro's high rate is but a reflection, a symptom as it were, of his subnormal and inferior place in the population. It may be strongly argued that it is at best difficult to progress beyond a very minimal point in the control of venereal disease in this group until their total economic and social circumstances are radically altered. Admitting, with sympathy, to the validity of these observations, the question remains of determining the practical and immediate measures to be set in motion. Whatever their nature, experience suggests that such measures must (1) reduce the rate of venereal disease infection, (2) respect the dignity of the individual, and (3) raise no unnecessary ob-

stacles for the future life and well-being of the individual.

The dischargee and future Navy man.—Reports during the months just preceding V-J Day indicated that a substantial portion of infections in the United States were occurring among men recently returned from duty afloat and overseas. Many of these men either had no opportunity for exposure while abroad, or by following a reasonably sane course of action escaped infection. Returning home, however, the bars are pushed down by a false sense of security in the American girl who "looks clean." The importance of maintenance of the health and morale of men scheduled for postwar duty as well as those being discharged is obvious. But at this point, at least, an effective educational and psychologic approach remains largely in the realm of conjecture. Needless to say, however, the Navy is giving special attention to demobilization as well as to future Navy problems. Trained venereal disease control officers are present at separation centers to assure personal interviewing of all personnel with histories of infection or with positive serologic findings. Additional educational work is carried on with all personnel awaiting discharge.

"Pro" and "con".—A central point of philosophic and practical differences in venereal disease control has long been the conflict between medical and moral prevention—in short, between prophylaxis and continence. The "first things first" point of view dictated that primary emphasis be placed upon those measures which directly and immediately influenced the infection rate and, consequently, the manpower loss. This has been attempted without ignoring other factors. Thus information about medical prophylaxis has been disseminated to all personnel because the apparently large percentage of men who have a tendency toward exposure cannot, in advance of infection, be distinguished from others.

Now gaining considerable force and momentum is the argument that such emphasis, while admittedly necessary, should not be exclusive in practical effect. It is pointed out that the paramount focus on prophylaxis builds up strong pressures against those in persons whose tendency is toward nonexposure. To be logical, the validity of continence should be taught to all personnel for the same reason prophylaxis information is made available to all. The counter-argument that the pro-continent group is not involved in the venereal disease problem is at least debatable when the full power of group pressures are appreciated.

Looking forward to the future, this "pro" and "con" debate assumes vital significance to the nation as a whole. The implications—not so much in physical as in mental hygiene terms—to the

possibilities of satisfactory personal, family, and communal adjustments after discharge from the service cannot be ignored. Undoubtedly these future adjustments are conditioned to some degree by present venereal disease education. One approach taken by the Navy is indicated by the theme "VD can be cured—but there is no medicine for regret."

It is from the horns of this dilemma that venereal disease control in the armed services and among civilians must extricate itself with all possible dispatch. Quite possibly the "pro" and "con" positions are not so far apart philosophically as they are in methodology; but it is pertinent to note that "the road to hell is paved with good intentions."

It may well prove that more intensive consideration of the practical potentialities of the venereal disease discipline concept may prove fruitful. For venereal disease discipline implies an objective of self-discipline, in the final analysis the fundamental and most significant prophylaxis.

MOTION PICTURES

The following motion pictures may be obtained through Training Aids Libraries and Training Aids Officers:

- MN-38** **SEX HYGIENE (B&W—20 min.)**
Describes how venereal diseases are contracted, the parts of the male anatomy infected, and the relative frequency of the various diseases. Examples of the diseases and preventive procedures are demonstrated. Stress is placed upon promptly reporting for prophylaxis after possible exposure. To be seen by all male Naval personnel.
- MA-4195** **PICK-UP (RESTRICTED) (B&W—36 min.)**
This dramatic film, for male personnel only, shows how a soldier contracts gonorrhea from a "pick-up." The film should be seen by all male personnel as part of their sex hygiene training.
- MG-937** **KNOW FOR SURE (B&W—20 min.)**
Treatise on the subject of syphilis, its prophylaxis and care. A film for male audiences, to give them further information on the cause and prevention of syphilis.
- MN-1712a** **PERSONAL HYGIENE FOR WOMEN (RESTRICTED) PART I. (B&W—44 min.)**
Depicts the general measures necessary to insure good health, including a balanced routine of sleep, exercise, and relaxation. High standards of personal cleanliness and good grooming are emphasized. By means of animated sequences, the anatomy and physiology of the female reproductive organs are shown. This film should be seen by all WAVE personnel.

- MN-1712b PERSONAL HYGIENE FOR WOMEN (RESTRICTED) PART II. (B&W—32 min.)**
This film depicts the hygienic measures necessary to prevent the spread of contagious diseases. A portion of the film is devoted to venereal disease. This film should be seen by all WAVE personnel.
- MA-3658 THREE CADETS (B&W—22 min.)**
A dramatic film which shows how three Air Corps Cadets meet the problem of venereal disease—one used prophylaxis, another, although he contracted venereal disease, reports promptly for treatment; the third one conceals his infection and attempts self-treatment with disastrous results. This film should be seen by all male personnel.
- MG-2355 FIGHTS SYPHILIS (B&W—10 min.)**
The story of syphilis showing avenues of contagion, diagnosis, and the efforts being made for control. General use for all audiences.
- MG-1001 HEALTH IS A VICTORY (B&W—12 min.)**
The story of the fight against gonorrhea. Describes the appearance of the gonococcus, and the frequency and symptoms of the disease. Also some of the steps in the isolation of the organism, how the disease spreads, and methods of treatment. For instructional use—all male personnel.
- MN-2454a ONE A MINUTE (V.D. CONTROL SERIES) (B&W—11 min.)**
This is a dramatic short film pointing out in theatrical terms that almost all prostitutes and easy women have venereal disease. It should *not* be shown as a training film but should be placed on the *entertainment* program. Consult the District V. D. Officer about this one.
- MN-2454b LETTER TO MARY (V.D. CONTROL SERIES) (B&W—11 min.)**
This is a dramatic short film which tells the story of the "last fling" of a sailor who is about to be married. It underscores the fact that you can't tell by looking if a girl has venereal disease. It should *not* be shown as a training film but should be placed on the *entertainment* program. Consult the District V. D. Officer.
- MN-2454e THE STORY OF THE DE 733 (V.D. CONTROL SERIES) (B&W—58 min.)**
This is a dramatic-type feature-length film reviewing virtually all aspects of the venereal disease problem, including education, prophylaxis, contact investigation, line responsibility, and the danger venereal disease is to the fighting efficiency of the Navy. Emphasis is on the fact that venereal disease control is a matter of prevention, and prevention is a responsibility of *everyone* in the Navy. *Restricted* to men.

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ZEPHIRAN HYDROCHLORIDE IN FUNGUS INFECTION OF THE EAR

Aqueous zephiran hydrochloride 1:5,000 when used once daily to syringe the ear canal is quick, easy, painless and remarkably effective against fungus infection of the external auditory canal. It is harmless provided the ear drum is intact, but if there is any doubt of the integrity of this structure no syringing should be done. The most severe case requires 6 days of treatment before the ear returns to normal. Other cases required 3 days. As a measure to prevent recurrence of infection, the treatment should be continued for 10 days. From 50 to 100 cc. of the solution is instilled; solutions stronger than 1:1,000 cause desquamation in the canal. No cotton plug or other medication is necessary.—LOWRY, E. F., JR., Lieutenant, junior grade (MC) U.S.N.R.



PATHOGENICITY AND pH OF MICROORGANISMS

Pathogenicity of bacteria and fungi seems to be related to tolerance for different degrees of pH; it may be possible to differentiate pathogenic from nonpathogenic microorganisms by growth in alkaline broth, and it may be possible to change a virulent microorganism into an avirulent one by an antitryptic agent. Although these possibilities apply to certain bacteria, they do not apply to all. Changing a favorable environment for one variant of *Micrococcus tetragenus* to one unfavorable to it did not necessarily direct variation toward the form best suited to the changed conditions. Variants seem to appear by chance, and if a variant appears which finds the new environment favorable, life of the strain is continued.—REIMANN, H. A.: Relationship between pathogenicity and pH tolerance of microorganisms. *Science* 102: 71, July 20, 1945.

RECENT OUTBREAK OF STREPTOCOCCAL INFECTION¹

On 11 November 1944 an outbreak of streptococcal illness began at the U. S. Naval Training School, Del Monte, California. Eighty men developed scarlet fever during the period from 11 November 1944 to 3 February 1945. This report is a summary of the epidemiologic study conducted during the week ending 13 January.

Epidemiologic situation.—There were approximately 1,700 persons at this Naval activity, of whom 1,300 were enlisted personnel under instruction as radio technicians. This student population comprised the principal group in which the outbreak occurred. Three months were spent at this station during the training period. The majority of the men had been in the Naval service about 6 months and had completed preliminary courses in radio. Every 2 weeks a new class of 200 students arrived from various preradio schools.

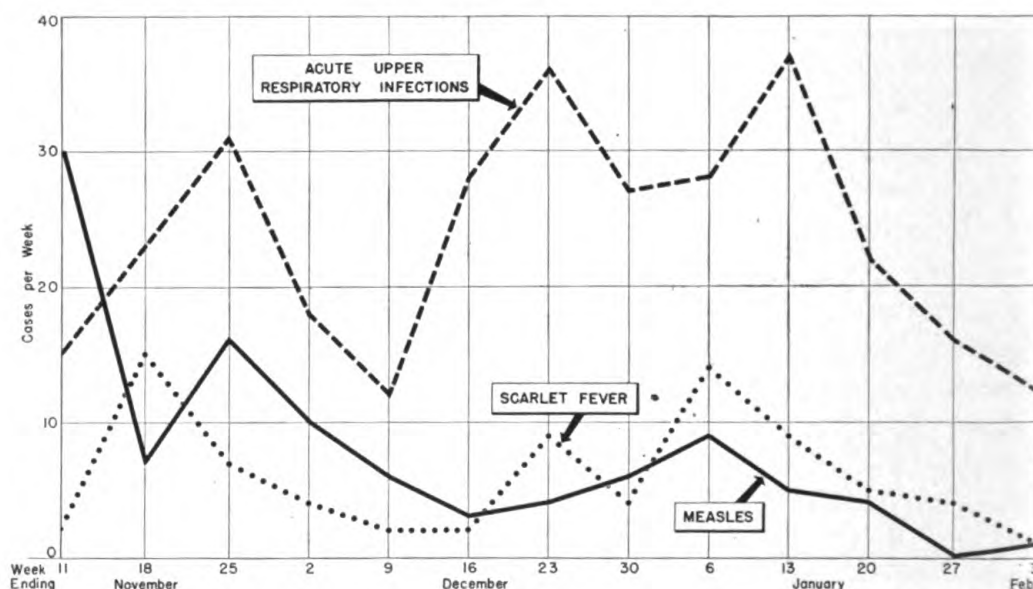
An inspection of the living quarters, shops, classrooms, recreation facilities, and galleys revealed satisfactory conditions throughout.

Description of epidemic.—Until 11 November 1944 the number of cases of scarlet fever and acute tonsillitis with pharyngitis at this station was low. Just prior to the outbreak of scarlet fever there was a sharp rise in the incidence of German measles. This began on 6 November among four members of a class which had been in residence 6 weeks. The outbreak continued during the next 3 months and chiefly affected the older classes. Ninety-five cases were diagnosed during the period 6 November 1944 to 11 January 1945. These cases of German measles were mild and of short duration.

On 11 November 1944, 5 days after the onset of the German measles outbreak, a new class of 200 men arrived at this station from 2 preradio schools in Chicago. Two cases of scarlet fever from this group were admitted to the sickbay from the train. Within 24 hours 6 more cases were admitted, and in the period from 11 to 18 November, 14 cases of scarlet fever occurred. On 17 November scarlet fever began to appear in other classes. At

¹ Abstract from a special epidemiologic report submitted by Lieutenant Clifford L. Spingarn (MC) U.S.N.R.

the Naval Training School there were 28 cases of scarlet fever during November, 19 cases during December, and in the period from 1 January to 13 January there were 23 cases. During the latter part of January the morbidity rate for this disease declined rapidly. These observations are shown in the accompanying graph.



Morbidity from scarlet fever, measles, and acute upper respiratory infections at the U. S. Naval Training School, Del Monte, Calif., from 4 November 1944 to 3 February 1945.

Clinically most of the cases seen at the school were mild. They were marked by acute tonsillitis or pharyngitis, low-grade fever, and an erythematous punctate rash which cleared within 1 to 3 days. Desquamation was common. There were few complications. All cases were treated with full doses of sulfadiazine for varying periods. Beta hemolytic streptococci were recovered from throat cultures of an entire group of 25 patients studied from 6 to 11 January.

Mode of spread.—A study of the morbidity data showed that the incidence of scarlet fever increased after the arrival of each of three new classes, namely, classes 19, 22, and 23. These men came from preradio schools in Chicago which were experiencing streptococcal outbreaks of epidemic proportion. On investigation it became apparent that cases of scarlet fever and acute tonsillitis or pharyngitis had occurred in each class while the drafts were in transit from Chicago to Del Monte, California.

1. Six members of Class 19 who contracted scarlet fever stated that they became ill with sore throats from 1 to 3 days after the trip began from Chicago. There was a definite history of contact

with personnel on the train who had had scarlet fever in Chicago.

2. Three members of Class 22 had sore throats on the train. Two other patients had been in contact with one or another of the three on the train.

3. An opportunity to study an entire draft of 196 men (of Class 23) clinically and bacteriologically on arrival at Del Monte was afforded on 6 January 1945. About 41 members of this draft had clinical evidence of acute tonsillitis or pharyngitis on arrival. Four were immediately hospitalized for scarlet fever and eight more cases were apparent within 48 hours. This draft, coming from two schools, was berthed in eight Pullman cars and messed in one diner. Members of the draft waited on tables. A sickbay was set up in one car and a pharmacist's mate put in charge. Two members of the class became ill with scarlet fever within 18 hours after the train left Chicago on 2 January and were hospitalized at a Naval activity in Nebraska. One of them had a sore throat 2 days before departure. During the next 3 days six contacts in the same car with this man developed sore throats and rashes. Cases of scarlet fever and acute tonsillitis or pharyngitis also occurred in other cars and the evidence of direct contact among these persons was clear. It was possible to locate 156 men according to the cars occupied during the trip. In every car at least 10 percent of the personnel had evidence of acute tonsillitis or pharyngitis. In two cars the average was 35 percent and 30 percent. Three porters who attended this draft became ill during the latter part of the trip and were admitted to a civilian hospital on 6 January 1945. Two were treated for acute tonsillitis and one was treated for acute meningitis due to *Streptococcus pyogenes*. These men had played cards together nightly.

From the above findings it was reasonable to assume that an epidemic of scarlet fever and acute tonsillitis or pharyngitis was caused by the introduction of infected men from the preradio schools, Chicago, where epidemic streptococcal conditions existed. Bacteriologic investigation fully supported this view.

Bacteriologic observations.—Throat cultures were obtained from 389 persons during the period from January 6 to 11. The latest draft (class 23) showed a carrier rate of 51 percent. Eighty-five percent of the patients with scarlet fever and acute tonsillitis or pharyngitis from this class were infected with these organisms. In the old population, 76 percent of 44 admissions to the sickbay for scarlet fever, acute respiratory diseases, or measles harbored streptococci. The carrier rate among the well portion of the old population was approximately 26 percent. The results indicated a greater density of hemolytic streptococci in the new class than in the old population. It was also apparent that

a high rate of carriers existed in the latter, probably a factor responsible for the continued occurrence of streptococcal disease in this group.

Studies of the strains of streptococci were undertaken by the Streptococcal Typing Laboratory at the National Naval Medical Center, Bethesda, Maryland. The report showed that the prevalent strains were predominately type 19 and a few were type 3. The majority tested were sulfonamide resistant. A report of the typing and resistance studies of strains sent from the Chicago preradio schools, where an intermittent sulfadiazine prophylactic program was in effect during November and December, revealed that types 19, 17, and 3 were prevalent there and some of these strains likewise were sulfonamide resistant.

Control measures.—The following control program was instituted:

1. The segregation of incoming personnel as completely as practicable.
2. Isolation of all patients with acute respiratory diseases.
3. Limited quarantine of the station until the epidemic of scarlet fever abated.
4. Cessation of the use of the swimming pool and movie theater.
5. Dust control measures and airing of blankets.
6. Daily inspection of all food handlers for acute respiratory diseases.
7. The use of only bottled milk and packaged food in the ship-service fountain.
8. The Commandant, Ninth District, was advised by dispatch of the conditions existing among drafts of men coming from preradio schools in Chicago.
9. Sulfadiazine prophylaxis was not recommended.

SUMMARY

The outbreak of scarlet fever and acute tonsillitis or pharyngitis was caused at the Naval Training School, Del Monte, California, by the introduction of persons sick with streptococcal disease and a large number of carriers from preradio schools in Chicago.

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UNITED STATES NAVAL MEDICAL BULLETIN



PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY

E 45

NUMBER 6



DECEMBER 1945

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED 112



COVER PHOTOGRAPH

Intent on his work of treating men wounded by Japanese gunfire aboard a patrol boat, a Naval medical officer swings his heavy kit through the air as he prepares to follow it into the small boat. Behind him a hospital corpsman holds additional medical supplies in readiness while other men, their attention fixed on the maneuver, stand by to lend assistance.

—Official U. S. Navy Photo.

VOL. 45

DECEMBER 1945

NO. 6

UNITED STATES
NAVAL
MEDICAL
BULLETIN



MONTHLY

DIVISION OF PUBLICATIONS
BUREAU OF MEDICINE AND SURGERY

Compiled and published under the authority of
Naval Appropriation Act for fiscal year 1946,
Public Law No. 62, approved May 29, 1945

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1945

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

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Original from
UNIVERSITY OF CALIFORNIA

NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

All numbers up to and including 1921.

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Volume 17, 1922, Nos. 4 and 6.

Volume 18, 1923, Nos. 1, 2, 3, and 5.

Volume 19, 1923, Nos. 2 and 3.

Volume 20, 1924, Nos. 2, 5, and 6.

Volume 24, 1926, Nos. 1, 2, and 4.

Volume 25, 1927, Nos. 1 and 4.

Volume 26, 1928, Nos. 1, 3, and 4.

Volume 27, 1929, No. 4.

Volume 28, 1930, No. 1.

Volume 31, 1933, No. 3.

Volume 42, 1944, No. 2.

SUBSCRIPTION PRICE OF THE BULLETIN

Subscriptions should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Yearly subscription, \$4; foreign subscription, \$5.

Single number, domestic, 35 cents; foreign, 45 cents, which includes foreign postage.

Exchange of publications will be extended to medical scientific organizations, societies, laboratories, and journals. Communications on this subject should be addressed to the Surgeon General, United States Navy, Washington 25, D. C.

PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

With the establishment of the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of that Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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Contributions to the BULLETIN should be typewritten, double-spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in headings and captions.

Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

ROBERT C. RANDELL, *Editor,*
Commander, Medical Corps,
United States Naval Reserve, Retired.

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U. S. NAVAL MEDICAL BULLETIN

VOL. 45

DECEMBER 1945

No. 6

SPECIAL ARTICLES

STUDIES ON LOUSE-BORNE RELAPSING FEVER IN TUNISIA

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I. CLINICAL AND EPIDEMIOLOGIC DESCRIPTION OF LOUSE-BORNE RELAPSING FEVER IN TUNISIA

The presence of relapsing fever has been recognized in North Africa since 1866, but not in an epidemic form until 1910, when Sergeant and Foley (41) and Lemaire (17) described a small outbreak in Algeria. The first relapsing fever in Tunisia was noted in 1903 when 20 cases were reported in the southwestern part of the country. Another case was seen in 1907, and three more in 1911. A large outbreak of 164 cases was reported by Nicolle and his coworkers in the Pasteur Institute of Tunis in 1912 (28) (29) (30) (31) (32) (33) and (35).

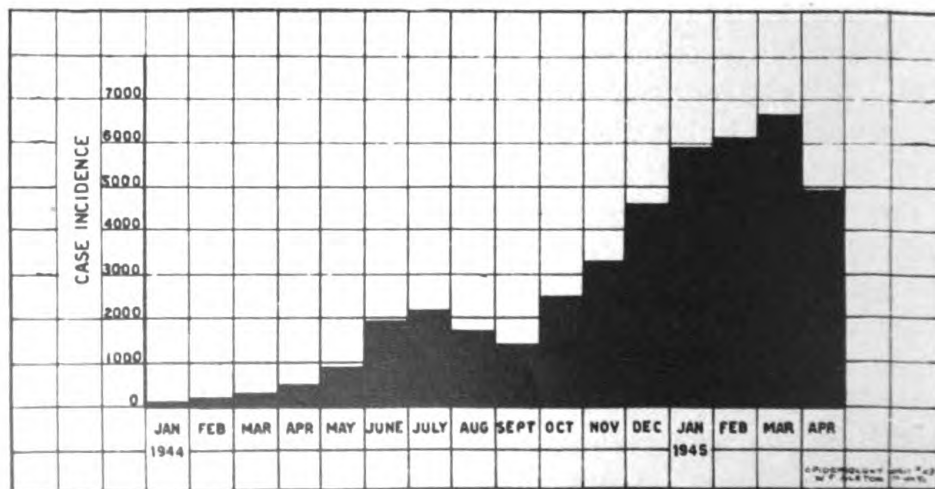
The role of the body louse in the transmission of epidemic relapsing fever was described at about the same time by these investigators in Tunisia and by Sergeant et al. (44) in Algeria. Since this outbreak there have been only sporadic cases of louse-borne relapsing fever in Tunisia, with none reported from 1923 until the present major epidemic which began in July 1943. At that time the first case was noted in an Italian prisoner of war from Tripolitania. A few more cases were observed in the closing months of 1943 but no epidemic appeared to be at hand. In Janu-

ary 1944, 8 cases were seen, in February 51, and by December 4,451 were recognized within 1 month. The peak of the epidemic was reached in March 1945 when 6,536 cases were reported in Tunisia. The public health authorities believe these statistics, which are given in detail in table 1 and figure 1, are approximately one-fifth of the actual number, when the unreported cases among the Arab population are included. From our observation of the Arabs in Ferryville this would appear to be true; they prefer suffering and dying unattended instead of asking for medical assistance.

TABLE 1.—Incidence of relapsing fever by months in Tunisia 1943-45

Month	1943	1944	1945
January.....	0	8	5,806
February.....	0	51	6,046
March.....	0	230	6,536
April.....	0	406	4,833
May.....	0	882	
June.....	0	1,919	
July.....	1	2,135	
August.....	0	1,656	
September.....	0	1,376	
October.....	2	2,308	
November.....	1	3,112	
December.....	2	4,451	
Total.....	6	18,534	23,221

The presence of tick-borne relapsing fever in Tunisia was first suspected by Nicolle and Anderson and other workers in the early 1920s, and a total of seven human cases was reported in the 1930s (1) (2) (23) (24) (25) (26) (27) (36) (45) and (49). An infected tick, *Ornithodoros erraticus* rather than *O. moubata*, was shown to be the insect vector, and *Spirochaeta hispanicum* (his-



1. Incidence of relapsing fever in Tunisia, 1944-45.

pano-africaine) rather than *S. duttoni* was considered to be the etiologic agent.

Our clinical observations were made on 40 patients in a special ward set aside for our use at the French Naval Hospital in Ferryville. Partial data on an additional 80 cases in the village of El Haouid, 71 in the village of Hadjerine, and 3,806 in the city of Tunis were also available to us, the latter through the courtesy of Dr. Paul Durand of the Pasteur Institute of Tunis.

The age distribution of patients from the village of El Haouid forms essentially the same pattern as that of the total population of the village, with all age groups represented. The mean age for the total village is 24.7 years and that for the cases is 22.6 years. Using standard statistical methods the observed difference of the means is greater than 5 times the standard error of the mean and is, therefore, statistically significant.

The mortality rate in the 201 patients treated in the French Naval Hospital in Ferryville is 0.5 percent, in the 80 untreated cases in the village of El Haouid 1.25 percent, in the 71 untreated



2. The petechial rash in relapsing fever in a 13-year-old Arab girl.

cases in the village of Hadjerine 46.5 percent, and in the 3,806 cases treated in the Ernest Conseil Hospital in Tunis 5.46 percent. The marked difference in the rates in the two comparable villages

of El Haouid and Hadjerine, both with populations of about 300 people, both with the same low sanitary standards, both in the same general area and both without medical attention, is hard to explain. Although all diagnoses in Hadjerine were confirmed by a laboratory, where spirochetes were demonstrated in blood smears, it is possible that another disease such as typhus, typhoid, or plague, all of which have been seen in recent months in that part of Tunisia, complicated the relapsing fever. This is particularly true for typhus which classically has appeared concurrently with louse-borne relapsing fever.

The signs and symptoms observed are essentially the same as those originally described by Sergeant and Foley (41) and Nicolle, Blaizot, and Conseil (33) in the first major epidemics in North Africa. In our group of 40 patients the most prevalent symptoms were fever, headache, generalized aching, and vomiting, with chills, epistaxis, abdominal pain, and weakness observed less frequently. The two signs that were evident in a majority of the patients were splenomegaly and a disseminated petechial rash over the chest, arms, and abdomen. The splenomegaly may have been associated with the current illness, but it is such a common finding in people of this part of the world that previous and associated diseases must be ruled out before it may be called a characteristic sign. Tenderness in the right upper abdominal quadrant with splenomegaly was seen in several of the patients, and in these it may legitimately be considered a sign of relapsing fever.

The petechial rash, which is inadequately shown in figure 2, appeared early in the course of the illness and began to fade after 1 or 2 days. The lesion in its evolution changed from bright red to a dull red and finally to brown, and in 4 or 5 days disappeared completely. Jaundice, which has been described previously by Nicolle et al. (31), Sergeant and Foley (42) and Noc and Nogue (38), was observed in three patients. In two cases it was very intense and in one quite mild. The icterus faded rapidly in all three patients. The signs and symptoms described above are listed in order of frequency in table 2.

The number of relapses for louse-borne relapsing fever is usually described as one or two. In our series of cases we were not at liberty to leave selected patients untreated so that we might follow the normal course of the disease, but in the village of El Haouid, where no treatment was given, one or two relapses at 5- to 9-day intervals were reported. Durand (6) was able to select 112 patients who were in the optimal age group and nutritional state as untreated controls. The relapses in these patients are shown in table 3.

TABLE 2.—*Signs and symptoms of relapsing fever*

	Yes	Percent	No	Percent
<i>Symptoms</i>				
Fever.....	40	100	0	0
Headaches.....	36	90.0	4	10.0
Generalized aching.....	24	60.0	16	40.0
Vomiting.....	19	47.5	21	52.5
Chills.....	11	27.5	29	72.5
Epistaxis.....	7	17.5	33	82.5
Abdominal pain.....	4	10.0	36	90.0
Weakness.....	4	10.0	36	90.0
<i>Signs</i>				
Splenomegaly.....	25	62.5	15	37.5
Petechial rash.....	24	60.0	16	40.0
Hepatomegaly.....	18	45.0	22	55.0
Jaundice.....	3	7.5	37	92.5

TABLE 3.—*Relapses observed in untreated relapsing fever at the Ernest Conseil Hospital, Tunis, 1944-45*

Number of patients	Number of relapses					
	None	1	2	3	4	5
112.....	11(10%)	71(62.5%)	25(22.3%)	2(1.7%)	2(1.7%)	1(0.8%)

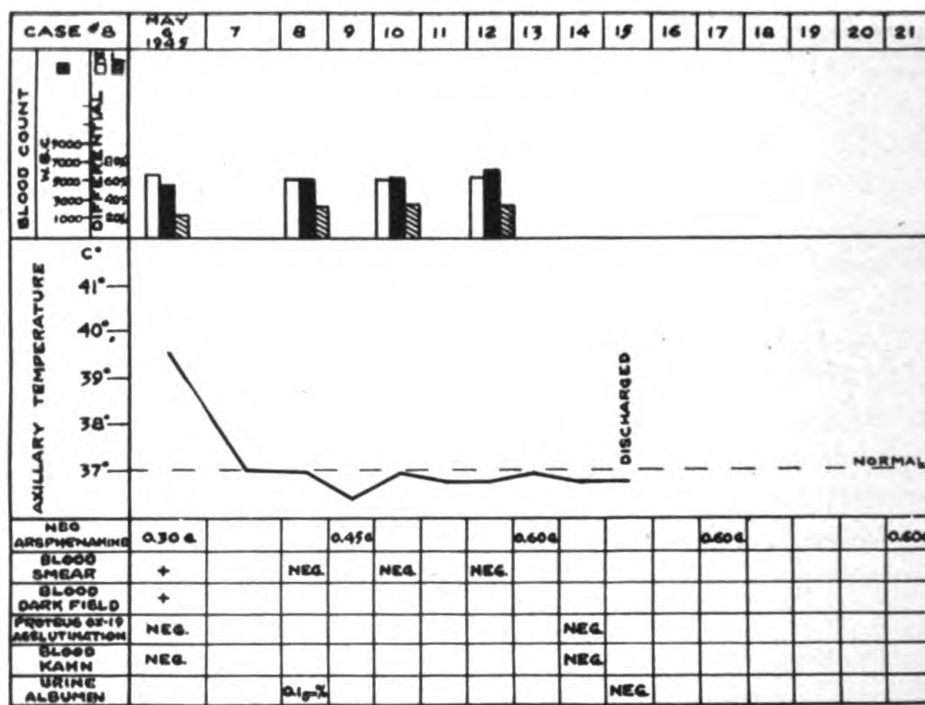
Laboratory studies on patients.—Each of the 40 patients included in our clinical series was studied extensively by means of the conventional laboratory methods. The following procedures were instituted:

1. Leukocyte and differential count every other day for 8 days.
2. Blood smear examination for spirochetes every 6 hours for 48 hours on all patients treated with penicillin.
3. Blood smear examination for spirochetes every other day for 8 days on all patients.
4. A blood darkfield examination before treatment.
5. Blood Kahn tests at the beginning and end of the hospitalization.
6. Serum agglutination with proteus OX-19 antigen at the beginning and end of the hospitalization.
7. Urinalysis.

The results of these laboratory studies are as follows:

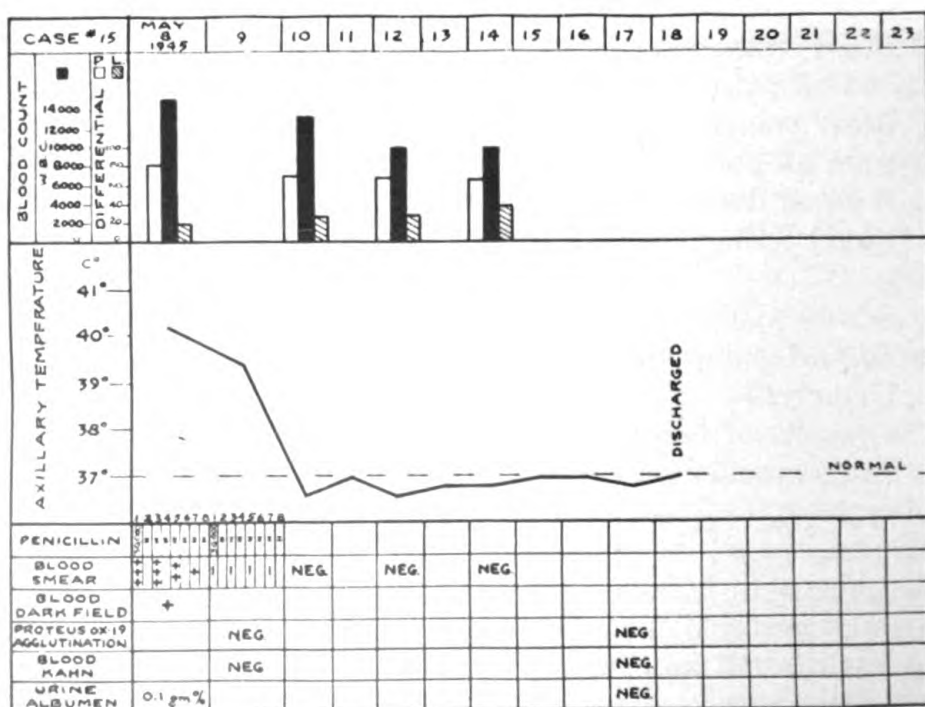
1. Leukocytosis, which is considered the classical finding in relapsing fever (14) (33) and (46), was present either initially or during the course of the disease in only 8 patients (20 percent). When leukocytosis occurred it was always neutrophilic. In 8 patients (20 percent), leukopenia with a relative lymphocytosis was observed. In 24 patients (60 percent) a normal leukocyte count and normal differential count were seen throughout the course of the illness. Leukopenia and leukocytosis respectively are shown in

figures 3 and 4. One of the most constant findings was a complete absence of eosinophils in all patients even after the illness was clinically terminated.



3. Clinical findings in case 8.

EPIDEMIOLOGY UNIT #3
W. FALSTON PMM



4. Clinical findings in case 15.

EPIDEMIOLOGY UNIT #3
W. FALSTON PMM

2. Blood smears on patients treated with penicillin will be discussed in section II of this report.

3. Initial thin blood smears stained with Wright's or Giemsa's stain were positive for spirochetes in all patients who are included in our series. Frequently the blood became negative within a few hours or turned from negative to positive during the same day but all patients that we treated were confirmed cases.

4. A close correlation existed between the results of the blood darkfield examination and those of the stained thick or thin smears prepared at the same time. In only one instance was the darkfield examination negative when the stained smear was positive. The spirochetes on darkfield examination showed great variability in length, ranging from 10 to 25 microns. The rapid corkscrew-like motility was a constant feature. The maximum number of spirochetes observed in one field was fifteen.

5. T'ung and Chung (47) in discussing relapsing fever in China reported that 7.95 percent of their patients showed transitory positive Wassermann or Kahn tests. In 5 of our series (12.5 percent) a positive blood Kahn test was found. In two the Kahn was positive on both first and second examinations, in two it changed from positive initially to negative on second examination, and in one it changed from negative to positive. In the three patients who showed a change the Kahn may be considered to be a false positive reaction from relapsing fever. In the two patients with the constant finding of a positive (4+) Kahn test, the diagnosis of syphilis must be considered.

6. Serum agglutinations with proteus OX-19 antigen (Weil-Felix test) were negative on all patients both initially and at the end of the illness. This agglutination was carried out to make sure that we were not dealing with typhus and relapsing fever concurrently.

7. Early in the course of their illness six patients showed a transient albuminuria which disappeared before the patient was discharged on the tenth day.

II. PENICILLIN IN THE TREATMENT OF CLINICAL AND EXPERIMENTAL RELAPSING FEVER

Many drugs have been successfully employed in the treatment of relapsing fever. Arsphenamine was considered to be the drug of choice by Sergent and Gillot (43) and Legendre (16) in the 1910-12 epidemics, where one injection of the arsenical was found to be effective in freeing the blood of spirochetes. Nicolle and Conseil in 1923 found that neoarsphenamine given in two doses of 0.45 and 0.6 gm. respectively produced a rapid and sure spiro-

cheticidal effect in patients. Feldt (7), Hawking (11), and Vargas and Zozaya (48) have reported on the use of the sulfonamides in the treatment of relapsing fever. Feldt and Hawking found both sulfapyridine and sulfathiazole to be effective in experimental mouse infections, while Vargas and Zozaya found sulfadiazine, sulfapyridine, and sulfanilamide to be ineffective against relapsing fever.

The use of penicillin in relapsing fever is logically suggested by the good results obtained with this drug in syphilis. It has been tried experimentally in mice infected with *Spirochaeta novyi* by Herrell and Heilman (12), and Augustine, Weinman and McAllister (3), and in mice infected with *S. duttoni* by Lourie and Collier (18). All of these investigators have reported that penicillin in a dosage of 500 units every 3 hours for 48 hours is effective in sterilizing the blood. To our knowledge no previous report of the use of penicillin in human louse-borne relapsing fever has as yet been made.

We originally planned to treat one-third of the patients with penicillin, one-third with neoarsphenamine, and leave the remaining third untreated as controls. The authorities at the French Naval Hospital in Ferryville requested us to modify this plan and treat all of the patients with some drug. We complied with this suggestion and treated every third patient with neoarsphenamine and the remaining two-thirds with penicillin. No selection of subjects was made except in the case of the three jaundiced patients whom we deliberately included in the penicillin group. The inadvisability of using an arsenical in the presence of jaundice dictated this arbitrary selection.

Neoarsphenamine in adults was given in the dosages shown in case 8 of figure 3. The first three doses of 0.3, 0.45 and 0.6 gm. were given on the first, fourth and eighth days respectively while the patients were in the hospital. The last two doses of 0.6 gm. each were given on the twelfth and sixteenth days in the outpatient clinic. In infants or children the dosage was reduced proportionately according to the weight. A total of 13 patients in our series and 161 patients under the care of the French medical officers in Ferryville received the same dosage of neoarsphenamine. In all patients the response to the drug was rapid and no relapses occurred.

Only one death occurred in this entire group, in a 60-year-old man who responded normally to the medication but who on the third day of treatment developed a fever which did not appear to be related either to the primary disease or the therapy. Blood cultures taken at this time were negative, as were repeated blood

smears. After 3 days the temperature returned to normal but the patient continued to be listless. On the morning of the sixteenth day, when he was about to be discharged, he was found dead in his bed. An autopsy has been performed but the findings are not known as yet.

An unusual history in one of the patients in the series treated by the French medical officers in Ferryville, was the development of relapsing fever while under treatment for syphilis with neoarsphenamine. Clinical evidence of the disease developed 4 days after an injection of the arsenical. However in spite of this apparent resistance to the drug he responded normally to an additional course of five injections of neoarsphenamine. Similar experience has been reported by Durand (5) in three patients and Johnson (13) in one patient.

In all, 27 patients were treated with penicillin. The dosage for adults was 30,000 units of calcium penicillin in normal saline intramuscularly every 3 hours for 48 hours, and 20,000 units by the same method for children below the age of 10 years. The total amount received was 480,000 units for adults and 360,000 units for children. The effect of penicillin on the spirochete was observed by examining thin blood smears obtained every 6 hours during the period of treatment and every other day for 6 days after treatment. In patients with only a light infection demonstrable in the blood, usually no spirochetes were observed after 6 hours. In those with a heavy infection (5 to 15 spirochetes per microscopic field with the 97-x objective) spirochetes were usually evident in decreasing numbers for 24 hours. In one patient the blood was positive for 42 hours but in none were spirochetes found at the end of 48 hours. All patients who received penicillin showed a rapid clinical recovery and none had a relapse. A typical course for a patient receiving penicillin is shown in figure 4.

Animal experimentation.—White mice have been employed in experimental relapsing fever by Sargent and Foley (41), Sargent and Gillot (43), Nicolle and Blaizot (28) and many other investigators (3) (7) (9) (10) (12) (15) (19) (20) (22) (39) (40) in subsequent years. Using the North African louse-borne strain, *Spirochaeta berbera*, or the European louse-borne strain, *S. obermeieri*, most workers agree that an infection in mice is only a transient or pseudo one when the infective material is human blood. A light spirochetal septicemia 24 hours after inoculation, which lasts for less than a day, is usually the maximum infection that may be expected. When infected monkey's blood or a laboratory strain in mice is employed, an infection of 2 or 3 days' duration is frequently observed.

TABLE 4.—Preliminary animal experimentation

No.	Animal	Source of infected material	Amount and mode of inoculation	Treatment	Results (days after inoculation)														Stained smear		Tissues		
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	Spl.	Liv.	Spl.	Liv.	Spl.	Liv.
Convalescent patient series																							
C4	Mouse	Conval. case 4	0.25 cc. blood I.P.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
C5	Mouse	Conval. case 5	0.25 cc. blood I.P.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
C6	Mouse	Conval. case 6	0.25 cc. blood I.P.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
C7	Mouse	Conval. case 7	0.25 cc. blood I.P.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
C8	Mouse	Conval. case 8	0.25 cc. blood I.P.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
C9	Mouse	Conval. case 9	0.25 cc. blood I.P.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
C10	Mouse	Conval. case 10	0.25 cc. blood I.P.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
C11	Mouse	Conval. case 11	0.25 cc. blood I.P.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
C12	Mouse	Conval. case 12	0.25 cc. blood I.P.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Penicillin treatment series																							
P1	Mouse	Heavy inf. case 29	0.25 cc. blood I.P.	500u. pen. q3Hx48H	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
P2	Mouse	Heavy inf. case 29	0.25 cc. blood I.P.	500u. pen. q3Hx48H	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
P3	Mouse	Heavy inf. case 29	0.25 cc. blood I.P.	500u. pen. q3Hx48H	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
P4	Mouse	Heavy inf. case 29	0.25 cc. blood I.P.	500u. pen. q3Hx48H	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
P5	Mouse	Heavy inf. case 29	0.25 cc. blood I.P.	500u. pen. q3Hx48H	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
P6	Mouse	Heavy inf. case 29	0.25 cc. blood I.P.	500u. pen. q3Hx48H	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
P7	Mouse	Heavy inf. case 29	0.25 cc. blood I.P.	500u. pen. q3Hx48H	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
P8	Mouse	Heavy inf. case 29	0.25 cc. blood I.P.	500u. pen. q3Hx48H	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
P9	Mouse	Heavy inf. case 29	0.25 cc. blood I.P.	500u. pen. q3Hx48H	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
P10	Mouse	Heavy inf. case 29	0.25 cc. blood I.P.	500u. pen. q3Hx48H	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
P11	Mouse	Heavy inf. case 29	0.25 cc. blood I.P.	500u. pen. q3Hx48H	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
P12	Mouse	Heavy inf. case 29	0.25 cc. blood I.P.	500u. pen. q3Hx48H	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Louse and flea transmission series																							
L1	Mouse	Lice cases 25, 27, 33	0.20 cc. sal. emul. I.P.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
L2	Mouse	Lice cases 25, 27, 33	Sal. emul. scar. abdom.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
L3	Mouse	Lice cases 68 and 69	0.20 cc. sal. emul. I.P.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
L4	Mouse	Lice cases 68 and 69	Sal. emul. scar. abdom.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
F1	Mouse	Fleas cases 68 and 69	0.20 cc. sal. emul. I.P.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
F2	Mouse	Fleas cases 68 and 69	Sal. emul. scar. abdom.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Guinea pig series																							
G1	Guinea pig	Heavy inf. case 68	1.25 cc. blood I.P.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
G2	Guinea pig	Heavy inf. case 69	1.25 cc. blood I.P.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
G3	Guinea pig	Heavy inf. case 64	1.25 cc. blood I.P.	None	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

NOTES

Pen. = Penicillin
 q3H = every 3 hours
 48H = for 48 hours

I.P. = Inoculated intraperitoneally
 sal. emul. = saline emulsion
 scar. abdom. = scarified abdomen

S = Sacrificed
 D = Died
 E = Escaped

Adult guinea pigs are considered by most investigators to be resistant to the North African strain of *Spirochaeta recurrentis* and only moderately susceptible to *S. duttoni*. Young guinea pigs are slightly susceptible to *S. berbera*. Rabbits, bats, and white rats have been employed for spirochetal experimentation, but they are not receptive animals for most strains of *S. recurrentis*. Macacus monkeys are the animals of choice for either transmission or treatment studies (4) (33) (37) of relapsing fever.

A detailed résumé of our animal experimentation is shown in table 4. Mice C4 to C12 were inoculated intraperitoneally with 0.25 cc. of citrated blood from convalescent patients on the ninth or tenth day of their illness. This was attempted to determine if, after treatment with either penicillin or neoarsphenamine, the peripheral blood was actually sterile by a biologic test as well as by a microscopic examination. All 9 mice remained well and free of demonstrable spirochetes in their peripheral blood. Three were sacrificed on the eleventh day after inoculation. Stained smears of the liver and spleen as well as sections of these organs stained with hemotoxylin and eosin or silver impregnation (silver nitrate method) were negative for spirochetes or anatomic pathosis.

Mice P1 to P12 were inoculated with blood from two patients with heavy infections in an attempt to repeat the work of Augustine et al. (3), Herrell and Heilman (12), and Lourie and Collier (18) on penicillin but using *Spirochaeta berbera* as the spirochete. In all 12 mice we were able to produce a light infection in 24 hours, as demonstrated in the peripheral blood, but no spirochetes were found 48 hours after inoculation in the 5 control mice, in the 4 mice treated with 500 units of calcium penicillin intraperitoneally every 3 hours for 48 hours, or in the 3 mice treated in the same manner for 24 hours.

Two control mice and 1 treated mouse died on the third day, and 1 treated mouse on the eighth day of the experiment. In all 4 of these mice, stained smears and sections of the spleen and liver were negative for spirochetes and anatomic pathosis. This same observation is true for the remaining 8 mice which were sacrificed on the tenth to fourteenth day of the experiment, with the exception of mouse P6. The liver from this animal showed a nodular type of round cell infiltration scattered throughout the liver lobules. These could be pathologic changes produced by the experimental infection but they also could be explained with as much justification by postulating a previous infection of unknown causation in the mouse. Our only conclusion from this limited study is that white mice are not susceptible animals for the North African louse-borne strain of *Spirochaeta recurrentis* obtained directly

from human blood, and therefore are not suitable animals for a penicillin study. This conclusion, that mice are nonsusceptible animals, has been reached previously by numerous workers and as early as 1910.

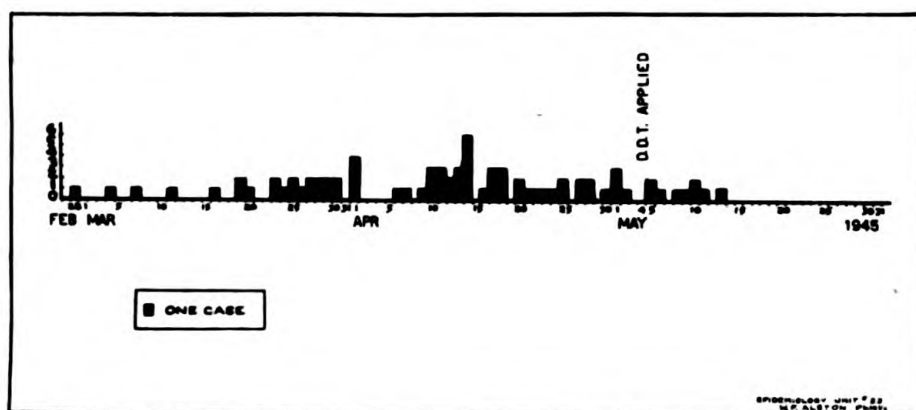
Transmission of *S. berbera* by *Pediculus humanus* (vestimenti) was demonstrated in 1911 by Sargent et al. (44) and in 1912 by Nicolle et al. (30) (33) in monkeys. They showed both biologically and anatomically that neither the bite nor the feces of the louse was infective and that it was necessary to crush the louse on the skin of the host to get transmission. Mice L1 to L4 and F1 and 2 are a very limited series which demonstrate that this experiment of Nicolle et al. cannot be reproduced in mice. The lice and fleas were obtained from proved cases of relapsing fever. They were emulsified in saline and then inoculated into the animal both intraperitoneally and on the scarified skin of the abdomen. All smears of blood and tissues and sections of spleen and liver were negative.

Although it was evident from the literature that adult guinea pigs were not susceptible to *Spirochaeta berbera*, we did inoculate three of these animals (G1 to G3) intraperitoneally with 1.25 cc. of blood from human cases with heavy infections. This was done primarily to verify this observation but also to help to rule out the possibility that the epidemic we were dealing with was a tick-borne relapsing fever with *S. duttoni* as the etiologic agent. In guinea pig G3, a very light infection was demonstrable on the day after inoculation but this soon became negative and remained so for ten days. In pigs G1 and G2 no spirochetes were found in the peripheral blood. These animals were not sacrificed at the end of the experiment because of their scarcity and their need for other purposes at the French Naval Hospital.

III. CONTROL OF LOUSE-BORNE RELAPSING FEVER WITH 10-PERCENT DDT POWDER

Although DDT (dichloro-diphenyl-trichloroethane) has been used extensively and successfully in the control of louse-borne typhus, to our knowledge it has never been employed to stop or alter an epidemic of louse-borne relapsing fever. Two separate villages were chosen by us to make a controlled study of the effectiveness of DDT in checking such an epidemic. The first site was El Haouid, an Arab village of mud huts located halfway between Ferryville and Tunis. This village of 281 people is located on a 4,800 acre farm; it supplies the laborers for the French landowner. Figure 5 shows the incidence of illness during the past 3

months which clinically may be called relapsing fever, but which was not confirmed in every case by laboratory examination of the



5. Incidence of relapsing fever in El Haouid, Tunisia, 1945.

blood. Some and perhaps all of it is relapsing fever. We were able to demonstrate spirochetes in the blood of 10 cases with recent onsets. For purposes of description we will assume every illness to be relapsing fever whether proved or not. Photographs which demonstrate the habitations and habitants as well as the control work by us are shown in figures 6, 7 and 8.

The control program at El Haouid consisted of initial blood smears on all people who were sick or who had been sick in recent months. At the same time a louse survey was made on a repre-



6. The village of El Haouid, Tunisia.

sentative sample of the inhabitants. Then the entire population, without a single exception, was dusted with 10-percent DDT in talc. On this initial survey our entourage which included the civilian controller, a French Naval doctor, the manager of the farm, the Arab chieftain, our unit, and laborers, made a hut-to-



7. Blood survey in El Haouid.

hut coverage of the village. At each hut the sick and convalescent cases furnished thin-blood smears, representative members were examined superficially for lice, and each member of the household was dusted with 10-percent DDT from a Hudson hand duster. This dusting which was done without removing the clothing included the head, hat, arms, and front and back of the thorax. In the case of the men and children the pubic region was also in-

cluded but inasmuch as we were using male workers this was not practical with the Arab women. Bedding and extra clothing were also thoroughly dusted. A total of 50 people out of 56 examined (89.3 percent) showed both body lice and nits. Many showed in addition to this, head lice. No examination was made for pubic lice. As was mentioned previously smears of 10 of those with a recent onset of their illness were positive for *Spirochaeta recurrentis*.

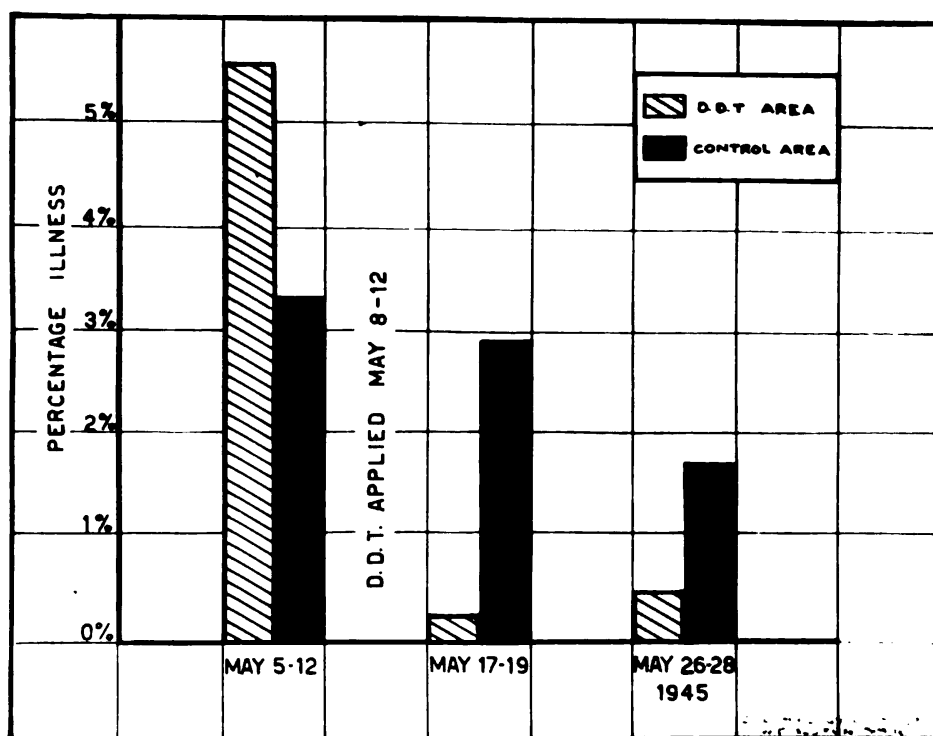
Again referring to figure 5, the results of this work may be visualized. Nine cases of relapsing fever were observed in the period between the fourth and thirteenth of May, or in the period after DDT was applied. These cases all began in what may be considered to be the normal period of incubation for relapsing fever. No case occurred after this incubation period. In addition to this cessation of the disease, in a second louse survey on 14 May 1945, no lice or nits were found on 75 people examined in the village. Inasmuch as (1) factors such as treatment, isolation of the sick from the well, and changes in sanitation were not in



8. Delousing of an Arab child.

operation, (2) the disease, although showing a decreasing incidence in many parts of Tunisia, continued to exist at an epidemic level throughout the month of May 1945, and (3) the louse population in the village of El Haouid was reduced from 89.3 percent to nil in a 10-day period, it seems justifiable to conclude that DDT alone controlled this epidemic and that the disease was truly louse-borne rather than tick-borne.

The Bellevue quarter of Ferryville was selected as the site for our second experiment in control of relapsing fever with DDT. This section presented the same living conditions, approximately the same high incidence of the disease, and, in addition, was large enough to permit its division into a treated and an untreated area. New problems presented here that did not exist in El Haoud were the lack of accurate statistics, the refusal of the people to seek medical attention, our inability to assemble the entire population at one time to be examined and deloused, and the intermingling of the treated with the untreated. Another factor in operation here which must be assessed when an evaluation of DDT is attempted, was the removal of all proved cases to the hospital for treatment as soon as they had been diagnosed. However this same factor operated in both the treated and the control area so it is counterbalanced and may be disregarded.



9. Incidence of relapsing fever in the Bellevue Quarter, Ferryville, Tunisia, May 1945.

The program in Bellevue was essentially the same as that in El Haoud with the exception that there were 851 persons in the area treated with only 653 of them dusted, or 76.7 percent. In the control area there were 1,436 people. No louse survey was made. Three hut-to-hut surveys to determine the number of people sick

and the number with positive blood smears were made simultaneously in the two areas. The results of these surveys are given in detail in table 5 and are demonstrated graphically in figure 9.

TABLE 5.—*Incidence of relapsing fever in the Bellevue quarter of Ferryville, May 1945*

		Total	No. deloused	Percent deloused	No. huts	No. sick	Percent sick	No. positive
May 5-12..	{ DDT.....	851	653	76.7	147	46	5.41	14
	{ Control....	1436	none	0.0	129	47	3.27	12
May 17-19..	{ DDT.....					2	0.23	1
	{ Control....					41	2.85	12
May 26-28..	{ DDT.....					4	0.48	1
	{ Control....					24	1.67	8

Statistical proof of significance in the difference between 6 new illnesses in the treated area and 65 new illnesses in the untreated area in the 2 weeks after the application of DDT is shown in the following data from a four-fold table: Chi square is 5.086, p is 0.00000057, and the probability of this occurring by chance is less than 2 in one million.

The value of DDT is more conclusively shown in this study than in the one in El Haouid, as the untreated area which lay on the opposite side of the road and the northern end of the treated area furnished adequate proof that the disease in that region had not ceased spontaneously. The presence of a few cases in the treated area would be expected, principally because only 76.7 per cent of the population was deloused, and secondly because of the intermingling of the deloused with the untreated population.

CONCLUSIONS

The following conclusions may be drawn from this study on the treatment and control of louse-borne relapsing fever.

1. Penicillin is as effective as neoarsphenamine in the treatment of relapsing fever. However it is more expensive and it requires more work to administer than the arsenical, so in the average case it offers no advantage.

2. Penicillin is probably the drug of choice in relapsing fever which is accompanied by jaundice.

3. The use of white mice or adult guinea pigs in experimentation on *Spirochaeta berbera*, obtained directly from human blood, is not feasible.

4. One application of 10-percent DDT powder, if thoroughly applied to a population, is nearly 100-percent effective in stopping a louse-borne epidemic of relapsing fever.

We wish to express our sincere appreciation to Médecin Général Gouriou, Médecin Principal Magrou, and Médecin Principal Brisou of the French Navy for their invaluable assistance and advice in this study; to the 15th Army Medical General Laboratory for supplying the white mice used in this work; and to Chief Pharmacist's Mate P. F. Thompson, U.S.N.R. for his technical assistance in the laboratory study.

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PROGNOSIS IN TREATMENT OF MALARIA

If, by careful study, the future course of malarial infections can be more clearly defined, it will be of real value to all those concerned, and during the course of these studies if the ideal drug, which would more rapidly terminate the course of this infection, should happen to be disclosed, the effects would be so far reaching that one would hardly be able to visualize its importance. These two possibilities remain in the future. In the absence of curative drugs, and with diseases that are gradually being eliminated by the defense mechanism of the host, our rationale of treatment is based on the concept that a physically fit body is equipped to throw off an infection more quickly than the one that is permitted to deteriorate mentally and physically by long periods of hospitalization.—COGGESHALL, L. T.: Malaria and filariasis in returning servicemen. *Am. J. Trop. Med.* 25: 177-184, May 1945.

REPORT ON CHOLERA STUDIES IN CALCUTTA

VALUE OF CHEMOTHERAPY IN THE TREATMENT OF CHOLERA AND USE OF BLOOD PLASMA IN CHOLERA COLLAPSE

EPIDEMIOLOGY UNIT NO. 50¹

With a view toward improving upon the methods of cholera therapy, a controlled experiment on the treatment of cholera in a highly endemic or epidemic area of India was undertaken. After a preliminary survey, arrangements were made with the Government of India, the School of Tropical Medicine, Calcutta, and the Campbell Hospital for Infectious Diseases, Calcutta, to carry out such an investigation in conjunction with work they were doing in this field. A brief summary of the study, taken from the report of Epidemiology Unit No. 50, is presented here.

Plans were made to investigate approximately 400 cases of cholera under several methods of therapy. The patients were taken in rotation as they were admitted to the hospital and assigned to the following groups according to the treatment given: (A) Sulfaguanidine; (B) control; (C) sulfadiazine; (D) penicillin; and (E) sulfadiazine and penicillin combined. This random sampling method was followed throughout the experiment.

All patients, including the controls, received supportive treatment in the form of intravenous hypertonic and normal saline solution and oral stimulants as indicated to offset dehydration, emaciation, and circulatory failure.

Group A received supportive treatment and in addition 3 gm. of sulfaguanidine in white paper packets, every 4 hours for 3 days and twice daily for the next 3 days, until a total of approximately 72 gm. had been given.

Group B (control) received supportive treatment and in addition an inert substance (3 gm. of calcium carbonate in brown paper packets every 4 hours for 3 days) to simulate the powders given the other groups (thereby eliminating any doubts between patients as to the type of treatment they were receiving).

Group C was given supportive treatment and in addition sulfadiazine in yellow paper packets in the following dosage: One gm. every 4 hours for the first day and 2 gm. every 4 hours for the following 2 days, making a total of 30 gm. for the 3 days.

¹ Commander Julius M. Amberson (MC) U.S.N.R. in charge.

Group D received supportive treatment and penicillin dissolved in normal saline solution, administered intramuscularly. Adults were given an initial dose of 100,000 units, and 25,000 units every 4 hours thereafter for a total of 200,000 units. In some cases, when the patient remained toxic, the treatment was extended until a total of three or four hundred thousand units had been given. Children under 10 years of age received 25,000 units for all doses including the initial one.

Group E received the combined treatments of groups C and D.

The majority of patients treated were drawn from the poor, uneducated classes of Calcutta. A total of 421 patients was treated, 49 of whom were subsequently determined not to have had cholera, leaving 372 cases of clinical cholera for evaluation in the study.

The noncholera cases were fairly evenly distributed among the various groups, which were divided as follows:

Groups	Total cases	Cholera cases
A Sulfaguanidine.....	118	104
B Control.....	62	52
C Sulfadiazine.....	116	101
D Penicillin.....	62	57
E Penicillin and sulfadiazine.....	63	58

Patients were admitted to groups A and C for two weeks longer than to the other groups in order to secure additional data for analysis. They presented various degrees of symptoms and physical signs which for purposes of classification were grouped into three types as follows.

1. *Ambulatory patients or simple diarrhea cases.*—These patients evidenced good circulation, and experienced no vomiting; bowel movements were effortless and few in number; there was slight dehydration only, and no suppression of urine. One saline infusion would usually suffice and the sulfonamide drugs assured early recovery.

2. *Typical or severe cholera.*—This type may be subdivided into two groups.

The first is characterized by severe purging and vomiting from 15 to 20 times a day. The urine is suppressed; muscle cramps, dehydration, general prostration, sunken face with an anxious expression, "pinched" nose, and weak and husky voice are all evident. The eyes are sunken, suffused, and listless, and the pulse is feeble and rapid. The patient is extremely thirsty and begs for water. Abdominal pain is rarely present and when seen, other enteric pathogens must be suspected.

The second type is the classic cholera shock or collapse case. This is the vasomotor type in which all the above symptoms are present and in addition there is circulatory collapse. The patient is acutely ill and usually cannot respond to questions, or if he can, it is with the weakest and smallest husky voice conceivable. The pulse is imperceptible, and the heart sounds are practically inaudible. The skin is moist with a cool sweat; the face is sunken, and the eyes are sunken, suffused and listless. The skin of the hands and feet are shrunk to a degree that ridges and valleys are formed all over these parts; the lips and fingernails have a peculiar dusky hue in the brown-skinned Indian; the nose is "pinched" at the alae; and the patient is restless and often will be gasping for air.

Upon attempts to administer intravenous fluids, the veins are found to be collapsed and difficult to enter. When entered, the dark tarry blood will rapidly clot in the needle if there is any delay in administration of the intravenous fluid. The blood pressure of these patients is impossible to obtain. After they are brought out of shock, the blood pressure is sometimes as low as 80/40. The urine is suppressed, and the temperature is subnormal. Diarrhea and vomiting are profuse, painless, and effortless.

3. *Dry cholera*.—This is a very rare type of cholera with extreme toxemia and practically no purging or vomiting. There is an apparent ileus; the bowels are laden with rice-water stools, and death shortly ensues. These cases are often misdiagnosed as cases of poisoning rather than cholera. Autopsy reveals rice-water stools in the small intestine, clots of blood in the right side of the heart, hyperemic kidneys, tarry dark blood, dark thick muscles, and fluid in the pericardium. Culturing of the intestinal contents yields the cholera vibrio.

The true cholera vibriones dealt with in the investigation of these cases were the subtypes, Inaba and Ogawa. The Ogawa strain was by far the more common, with 154 agglutinable cases as compared with 5 agglutinable Inaba cases.

It became apparent during the investigation that the usefulness of the therapeutic agents could not be fully established in the acutely ill patients because of the rapid progression into a state of shock, collapse, or death before the drug could be effective in combating the infection.

The salines administered were sufficient to offset dehydration, but the patients would lapse into shock and die of circulatory collapse. These patients were cyanotic; the pulse was imperceptible, and the heart sounds were inaudible. They were vomiting much watery fluid and effortlessly passing large quantities of fluid from

the bowel. The blood flowed with difficulty in the veins and frequent plugging of the intravenous saline needle was experienced.

USE OF BLOOD PLASMA

Facilities for accurate biochemic study of the body fluids retained and lost were not available; however it was deemed advisable to use blood plasma as a supportive measure to combat shock and prevent collapse. The results with plasma were impressive. The circulatory response was marked, the heart sounds became strong, and cyanosis disappeared quickly. The moribund patients who, prior to the use of blood plasma would have died, revived and began calling in Hindu, "paanee, paanee" (water, water).

The introduction of the plasma factor into a group had lowered the death rate of that particular group so as to give undue credit to the value of the drug used. It was believed that a much more accurate picture could be obtained by reclassifying all treated cases and placing them into three groups as follows:

1. Patients treated with plasma in addition to chemotherapy.
2. Patients receiving chemotherapy alone, i.e., penicillin, sulfadiazine, sulfaguanidine, or penicillin and sulfadiazine combined.
3. A control group consisting of all patients who had received no treatment, insufficient treatment, or supportive treatment only.

The number of deaths and survivals in each group was then determined and the results are given below. Three deaths which occurred are listed in the "lived" category because they had definitely recovered from cholera but died later of other causes. (One of these patients died from biliary blockage and heart failure 8 days after admission, another from pernicious anemia 6 days after admission, and the last one died of an embolism 6 days after admission.)

Results in all cases

Outcome	Plasma plus chemotherapy	Chemotherapy alone	Control
Lived.....	35	274	37
Died.....	0	3	23
Death rate.....	0%	1.1%	38.3%

The value of chemotherapy is clearly apparent. The administration of plasma in addition to chemotherapy completely eliminates the small percentage of deaths which occurs with chemotherapy alone.

The dramatic effect of plasma is still more evident if the frank

shock or collapse cases are segregated and tabulated. There were in all 78 severely ill patients who came under this classification.

Results in shock or collapse cases

Outcome	Plasma plus chemotherapy	Chemotherapy alone	Control
Lived.....	35	16	1
Died.....	0	3	23
Death rate.....	0%	15.8%	95.8%

The table clearly indicates that death is almost a certainty in cholera patients admitted in a state of collapse unless proper treatment is immediately instituted.

Chemotherapy with supportive treatment will effectively lower the expected death rate in cholera; however the addition of adequate amounts of blood plasma to the therapy of cholera will definitely assure recovery.



ATOPIC ASTHMA

Atopic asthma has the following characteristics: (1) Positive family, food, and inhalant histories; (2) other allergic manifestations; (3) pallor of the nasal mucosa and often of the uvula; cough which is late and tends to herald the end of the attack; (4) sputum which is glairy, mucoid, and frothy; (5) positive cutaneous and intracutaneous reactions to foods and inhalants; (6) diffuse wheezing; and (7) good response to adrenalin. The allergist treats this group successfully.—EDITORIAL: Classification of asthma. *J. Allergy* 16: 199-200, July 1945.



REDUCTION OF PAIN AFTER HEMORRHOIDECTOMY

Injection of alcohol, 1 or 2 drops at a time, just under the skin, using a tuberculin syringe with a $\frac{1}{2}$ -inch hypodermic needle, results in a sufficient anesthesia to permit hemorrhoidectomy and protracted relief of pain postoperatively. The injections are made 0.5 cm. apart in concentric circles which start at the anal margin and proceed outward. There has been no abscess or slough formation in a series of 72 cases.—OWINGS, J. C.: Methods for reducing pain following hemorrhoidectomy; technic and results in 72 cases. *Arch. Surg.* 50: 293-295, June 1945.

CARDIOVASCULAR DISTURBANCES IN TSUTSUGAMUSHI DISEASE

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Tsutsugamushi disease became increasingly important from a military viewpoint as the allied forces progressed more closely toward the endemic sites of the disease. In the past few months 35 convalescent patients from the Southwest Pacific who had had tsutsugamushi disease from 3 to 6 months previously have been admitted to this hospital. The diagnosis was established by the clinical course, rash, eschar and agglutination reaction. All these men had been ambulatory for from 1 to 3 months, but despite this fact the long period of physical disability which has resulted from their infection was strikingly apparent. Practically all of them had symptoms referable to the cardiovascular system, particularly weakness, palpitation, tachycardia, precordial pain, and dyspnea on slight exertion.

The rickettsial diseases have received considerable mention as a cause of acute myocarditis, second only to rheumatic fever and diphtheria. The first carefully detailed work was done by two independent commissions from Harvard University which studied typhus in Serbia in 1915 (1) and in Poland in 1920 (2). Their reports are published in excellent monographs which describe the acute clinical and pathologic manifestations but give no data on residual symptoms. In the Serbian epidemic, symptoms and signs of circulatory weakness were often noted but it is difficult, from the published reports, to tell whether there was cardiac or peripheral circulatory failure. The pulse was often weak, irregular and rapid, the blood pressure was low, functional systolic murmurs were heard, and at times cyanosis, sudden circulatory collapse and death occurred. The prognosis was often directly related to the cardiac rate, being poor when the rates were over 130. In the Serbian epidemic, 20 autopsies were done, and it was concluded that cardiac weakness and dilatation were largely responsible for death in 7 out of 20 cases. In the Polish epidemic, with 39 autopsies, microscopic lesions were present in the myo-

cardium in every case, and as the authors stated, of a degree and character making the diagnosis of typhus possible solely from the capillaries and the precapillary arterioles. These lesions are characterized by endothelial swelling, proliferation and necrosis with thrombosis, and by nodular perivascular exudation of lymphocytes, plasma cells, and monocytes, resulting in discrete and focal or diffuse myocardial lesions. This pathologic lesion has been called the "typhus nodule." The gross findings were not noteworthy except for moderate dilatation of the right ventricle.

All observers have commented on the rarity of involvement of the pericardium or endocardium. Careful studies of the aorta, other large vessels, and coronary arteries revealed no lesions.

Arkwright and Wilcox (3) also comment on the myocardial involvement in typhus fever. They noted that cardiac dilatation is common and that cardiac failure may supervene. Myocarditis is common and is shown by the rapid and feeble pulse which is occasionally irregular, by signs of dilatation of the heart, and poor heart sounds with the sounds being fetal in type. In severe cases a gallop rhythm may occur.

Reference to myocarditis occurring in rickettsial diseases other than typhus has also been noted in the literature and it has been stated that acute circulatory collapse or cardiac failure from rickettsial myocarditis may prove at times an important contributing factor in causing death.

The cardiovascular pathologic findings of tsutsugamushi disease have also been commented upon by Nagayo (4) who saw many cases in Japan. He states that in grave cases irregularity of the pulse is present in the early stage of the fever, though low tension and irregularities are common after the tenth day, when fatal cases mostly succumb, due to cardiac failure. Irregularity of the heart persists sometimes during convalescence. Corbett (5) recently described the clinical cases and autopsies of seven Americans who died of scrub typhus in the Buna-Gona area. He noted that the patients usually presented a rapid and occasionally irregular pulse and an increase in respiratory rate. He states that the patients usually died in cardiac failure, frequently with complicating bronchopneumonia, but that in a few cases cerebral symptoms predominated. In the autopsies he found that all cases had an acute diffuse myocarditis with perivascular and interstitial infiltration with round cells. The damage to the myocardial fibers varied in degree. The vasculitis and perivascularitis are similar to those seen in typhus fever.

In a recent article on tsutsugamushi disease in the Southwest Pacific, Ahlm and Lipshutz (6) noted clinical evidence of myo-

cardial damage late in the disease; in three patients this was manifested by gallop rhythm, reduplication of the mitral first sound, and muffled apical sounds. These findings were noted to be poor prognostic signs and were present in the one fatal case that occurred in their series.

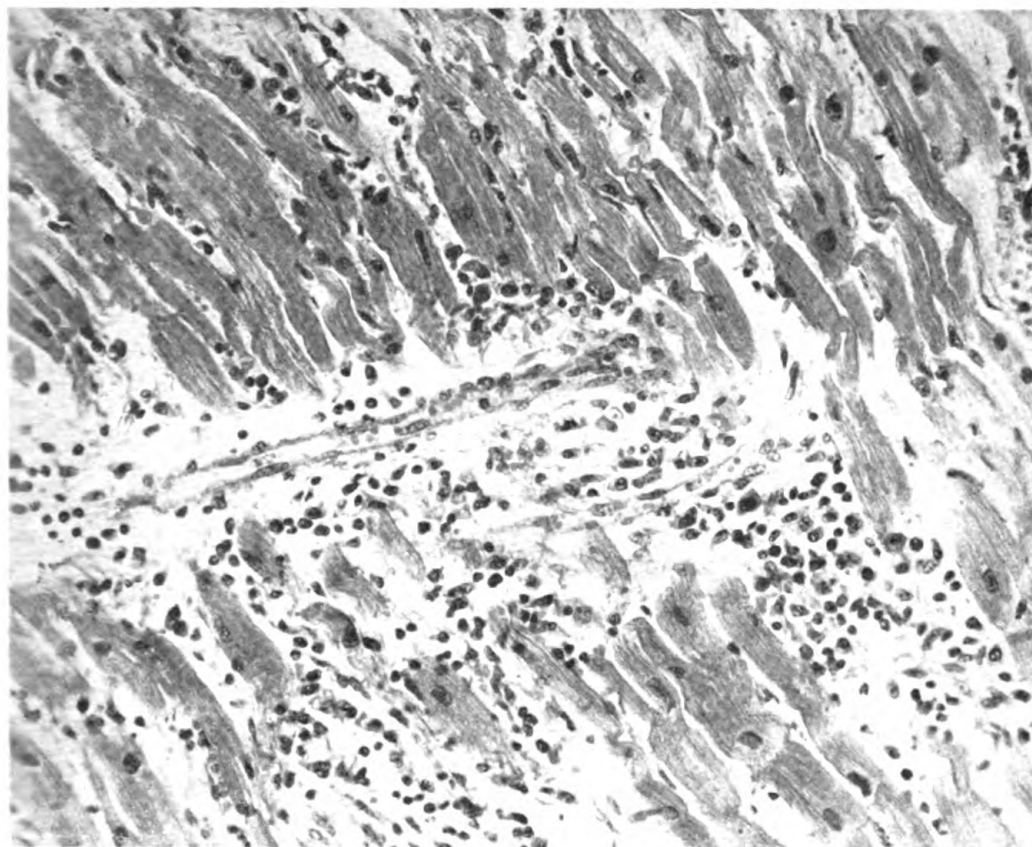
Logue (7), in discussing the cases seen in an epidemic of scrub typhus, stated that death usually occurred from myocardial failure with bronchopneumonia, and recommended that patients recovering from the disease should have a long convalescence. He noted that patients returning to duty after several months of convalescence have complained of severe fatigue and palpitation accompanied by a rapid pulse on exertion.

The most detailed recent article on the cardiovascular complications of tsutsugamushi disease reviews the findings in 200 cases seen in a station hospital in the Southwest Pacific (8). The authors describe the clinical findings and 6 autopsies. They state that myocarditis occurred in 45 percent of their cases, varying from mild to fulminant. In the mild form, only tachycardia occurred. In the severe form they noted accentuation and splitting of P_2 associated with cyanosis of the lips and mucous membranes and frequent auricular premature beats. In the fulminant form they observed severe dyspnea, auricular premature beats, profound tachycardia, auricular fibrillation, gallop rhythm, pulsus alternans, dicrotic pulse, collapsing pulse, cardiac dilatation (confirmed by x-ray) with evidence of congestive heart failure, systolic murmurs at the apical and pulmonary areas, and peripheral vascular failure.

Histologically, in the fatal cases, the myocardium showed patchy to diffuse inflammatory changes, characterized by perivascular monocyctic infiltration (fig. 1).¹ The vessels occasionally presented swelling and proliferation of the intima with actual infiltration of the wall. The authors noted that prolonged disability occurred, averaging from 2 to 3 months, usually due to weakness, palpitation, dyspnea on effort, and vague precordial pains. The tachycardia persisted for several months.

Electrocardiographic studies in typhus fever have only rarely been reported. Cimmino (9), studying 100 cases of louse-borne typhus, noted that the electrocardiogram in 46 percent showed slight damage, in 46 percent showed moderate damage, and in 8 percent severe damage. The chief findings were sinus tachycardia, changes in the P waves, a P-R interval more than 0.2

¹The authors are indebted to Dr. James A. Rinehart, Professor of Pathology at the University of California Medical School, for permission to reproduce the photomicrograph of tsutsugamushi myocarditis.



1. Acute tsutsugamushi myocarditis in a young man. Diffuse myocardial and perivascular infiltration by lymphocytes, plasma cells, and mononuclear phagocytes. Lymphocytes predominate. X 200.

second in 12 percent, and changes in the S-T segment in 36 percent. The electrocardiograms were taken on the first and eighth days of the disease. The author concluded that the findings are in keeping with what is known of the cardiac disturbances in typhus fever, including the frequent tendency to aggravation after the fall in the temperature of the patient.

In an excellent recent paper, Woodward and Bland (10) conclude that the circulatory collapse seen in typhus is peripheral in origin. They obtained electrocardiograms on 38 patients during the active phase of the disease. There were no striking abnormalities found in conduction or in T wave changes, but 45 percent showed minor abnormalities (low voltage, slurring of the QRS complexes, borderline ST and T wave changes and slightly delayed auriculoventricular conduction).

Clinical material.—With this background of clinical and pathologic evidence of acute myocarditis in the typhus group of fevers, and the military significance of prolonged convalescence in a disease occurring with increasing frequency in its personnel, it was

thought of importance to record studies of the residual disturbances noted in patients convalescent from tsutsugamushi disease.

Thirty-five patients were studied, all of whom had acquired tsutsugamushi disease in the Southwest Pacific. They were practically all young men, with an average age of 22 years. A few had been convalescent 3 months, but the majority as long as 5 months; the average interval from the onset of the disease was 4.7 months. All the patients had been ambulatory for at least from 6 to 8 weeks, many for as long as 3 months. The symptoms in all were strikingly similar and varied only in degree.

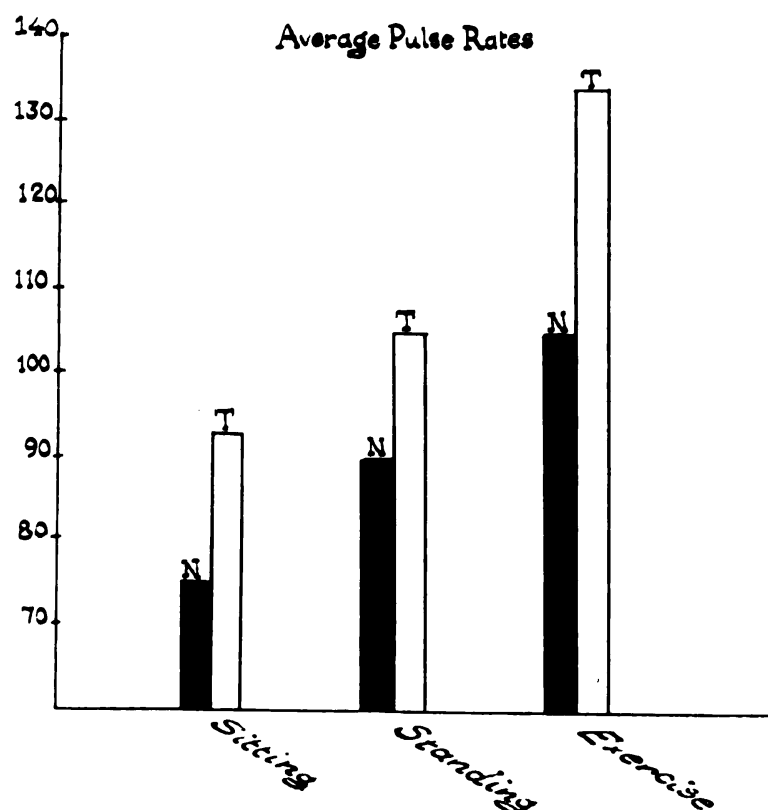
Findings.—The predominant symptoms were fatigability, weakness, dyspnea and palpitation on slight effort, and precordial pains. Dyspnea and palpitation were slight in approximately 60 percent, moderately severe in 30 percent, and absent in 10 percent of the patients. Examination of the heart revealed no evidence of valvular disease or of pericarditis. A number of the patients had soft functional pulmonary and apical systolic murmurs. The heart sounds were occasionally muffled, but there was no instance of gross abnormality of the sounds, such as gallop or tic-tac rhythm. There were no evidences of cardiac failure such as venous distention, pulmonary râles, enlargement of the liver, or peripheral edema. No patient had clubbed fingers. A striking feature noted in approximately one-third of the cases was vasomotor disturbances of the patients' hands and feet, manifested by mottled coldness, clamminess, and acrocyanosis. These latter features were obvious and distressing and were present even on warm dry afternoons. Except in one or two instances, none of the men previously had had any vasomotor disabilities of the hands or feet. Arterial insufficiency and gross venous abnormalities were not noted. None of the patients had had filariasis.

Electrocardiograms were obtained on all the patients. None showed gross abnormalities, but 7 showed minor variations. Three patients had slurring of the QRS complexes with borderline intraventricular conduction of 0.1 to 0.11 second. Two patients had borderline T changes (low to flat in leads I and IV), one had a marked right axis deviation with inverted T₂, and one had frequent nodal and ventricular extrasystoles, the latter from two foci. Two additional patients had notes in their health records which stated that they had had intraventricular conduction defects 2 months previously, and a third had left axis deviation and heart muscle damage, but their tracings were normal at the present time.

Estimations of the vital capacity, ability to hold the breath, and circulation time tests were done on a number of the men. In all of

those done the circulation time (decholin) was normal. A few had minor decreases in vital capacity, two men showing as much as 40-percent reduction. Breath-holding tests, on the contrary, were almost universally decreased, approximately 75 percent of the patients failing to hold the breath for the normal time of 45 seconds. The majority of the men were able to hold the breath only from 25 to 35 seconds, and seven could not hold the breath longer than 20 seconds.

Exercise tolerance test.—It was thought advisable, if possible, to demonstrate objectively and evaluate the cardiac symptoms of which the patients complained. A single test which has been extensively used to assess physical fitness is the response of the pulse and blood pressure to changes in posture and to exercise. In testing soldiers with effort syndrome during War I, Lewis (11) found that the subjective symptoms such as dyspnea and dizziness, following exercise, were of greater significance than were variations in the heart rate. Lewis observed that normal men in sedentary occupations were able to hop 20 times on each foot, raising the shoulders 6 inches with each hop, without significant



2. The average pulse rates sitting, standing, and after mild exercise in cases of this series as compared with normals. T represents tsutsugamushi cases. N represents normals.

respiratory distress or rise in pulse rate. He concluded that anyone obviously showing respiratory distress with this mild exercise test had poor tolerance to exercise. Threadgold and Burton studied the pulse responses in fit pilots of the RAF and determined the normal figures for the pulse in the sitting, and standing positions, and after an exercise test, to be 75, 90, and 105 respectively.

These responses were applied in 28 of the cases of tsutsugamushi disease comprising this report (fig. 2). The exercise was the same mild one used by Lewis, consisting of 20 hops on each foot, a total of 40 hops, clearing the floor by 3 inches. In normal persons this produces no significant symptoms. As can be seen from figure 2 and table 1, the average pulse rates of these men when sitting, standing and after exercise were consistently higher and the response to exercise was greater than in the normals.

TABLE 1.—*Comparison of average pulse rate in 28 patients with tsutsugamushi disease with that of persons of normal health*

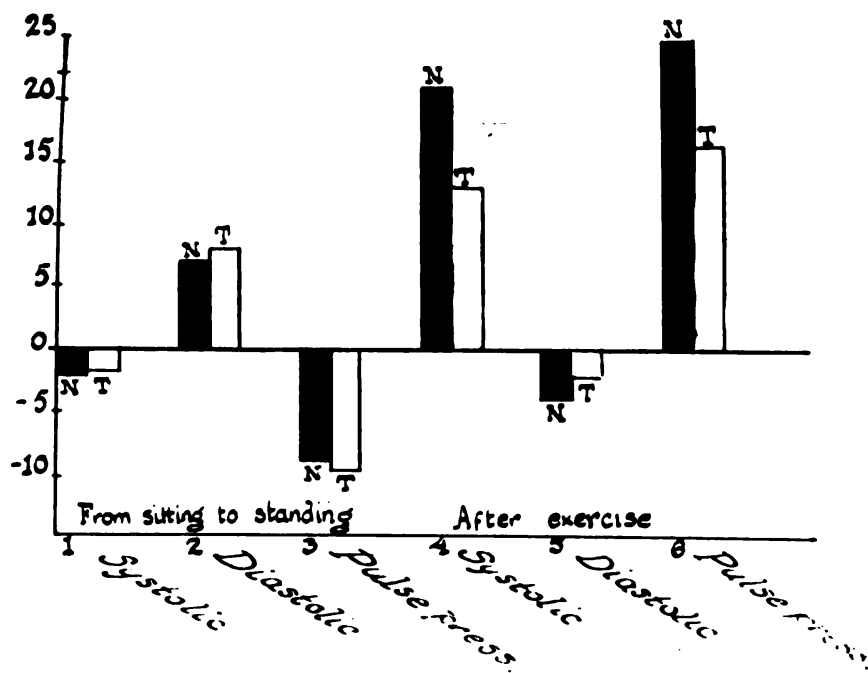
Posture	In tsutsugamushi disease	In normal health
Sitting.....	93	74
Standing.....	105	90
Postexercise.....	135	105
Reported symptoms.....	2+	0-1+

The abnormalities of the pulse and the symptoms produced by the exercise are significant of impaired physical fitness. In normal healthy persons 40 hops produce only minimal dyspnea, a sense of pounding of the heart, and precordial aching or dizziness. Seventy percent of the patients with tsutsugamushi disease had more than minimal dyspnea and palpitation, and 15 percent had moderately severe dyspnea, dizziness, aching, and palpitation from the exercise. Table 2 shows the pulse responses noted in the present series.

Kahn (12) studied the response of the blood pressure to exer-

TABLE 2.—*Pulse rate in 28 patients with tsutsugamushi disease*

Posture	Rate	Percent of cases
Resting sitting.....	90+ 100+	62 30
Resting standing.....	100+	60
Standing after exercise.....	120+ 130+ 140+	85 45 25



3. The blood pressure changes seen in assuming the standing position and after exercise in convalescent tsutsugamushi patients as compared with normals.

cise in normal persons and showed that the following changes occur normally. The average figures are compared for normals and for the 28 patients with tsutsugamushi disease (figure 3 and table 3).

TABLE 3.—Blood pressure response to exercise in health and in patients with tsutsugamushi disease

Pressure	19 normal persons (mm. Hg.)	18 patients with tsutsugamushi disease (mm. Hg.)
Systolic pressure from sitting to standing	-2	-1.7
Diastolic pressure from sitting to standing	+7	+8.0
Pulse pressure from sitting to standing	-9	-9.5
Diastolic pressure after exercise	+21	+13.0
Pulse pressure after exercise	+25	+16.3

The figures obtained on the 18 cases of tsutsugamushi studied indicate that the blood pressure responses in the patients of this series did not differ significantly from the normal responses to exercise.

It is therefore clear that two-thirds of the men had tachycardia on standing and from one-fourth to one-half had excessive pulse response on mild exercise. About three-fourths of the men had excessive symptoms on mild exercise, consisting of dyspnea, pal-

pitiation, fatigue, and dizziness. The return of the pulse and blood pressure to the pre-exercise level within 3 minutes occurred quite readily, but the symptoms persisted for a few minutes longer.

Roentgenologic and roentgenkymographic studies.—Cardiac roentgen examinations were performed on each case. The examinations included routine 6-foot posterior-anterior films of the thorax, and 4-foot posterior-anterior cardiac roentgenkymograms. In many instances roentgenoscopy was also performed. The routine roentgenograms were examined for cardiac size, shape, and position.

In view of the clinical findings of disordered function, and the apparent absence of reports of such studies, the kymographic findings will be reported in some detail.

Roentgenkymography is a method of recording some of the functional or physiologic movements of an organ on an x-ray film. The only movements accurately recorded in horizontal-slit kymograms are those occurring parallel to the slit. Kymograms are not intended to replace ordinary roentgen studies, but merely to supplement them. As Gubner and Crawford (13) have observed, kymograms give a permanent record of the motions of the heart, which upon inspection reveal details of movements which are difficult or impossible to see with the poor illumination and speed of motion that exist during fluoroscopic examination.

The kymograms were analyzed for the amplitude, shape, and timing of each cardiac wave (or contraction). Several authors have discussed the significance of variations in the amplitude and shape of ventricular contractions. These contractions are influenced by numerous factors, including the technic of examination, the status of the pulmonary structures, and the condition of the myocardium itself. Under standard and correct technical conditions, in adults with relatively healthy pulmonary and pleural structures, and without evidence of pericardial disease, abnormalities of contraction may reasonably be attributed to myocardial dysfunction of disease. In the group of young men reviewed in this paper, such conditions obtained.

The amplitude and shape of contractions normally vary somewhat from one person to another. Further, the shape of ventricular waves varies slightly along different portions of the ventricular border, especially when films are made in the left anterior oblique position. Therefore considerable caution must be maintained in drawing conclusions from such variations, especially if one is not personally certain of the exact technical and clinical conditions existing. The most important clinical application of the cardiac roentgenkymography is in the detection of

myocardial infarcts. However Stumpf and others have shown that in other myocardial disorders (myxedema, beriberi, etc.) alterations in the wave pattern have diagnostic and even prognostic significance. Stumpf believes that abnormal pointing or "peaking" of the left ventricular waves is indicative of myocardial irritability or inflammation (myocardial dysfunction or myocarditis). This change was observed by us in three patients with subsiding diphtheritic myocarditis.

The x-ray findings in our series of cases are as follows: Total cases examined, 35; cases showing kymographic changes, 14; cases showing x-ray evidence of cardiac enlargement, six. Four showed definite, two questionable enlargement.

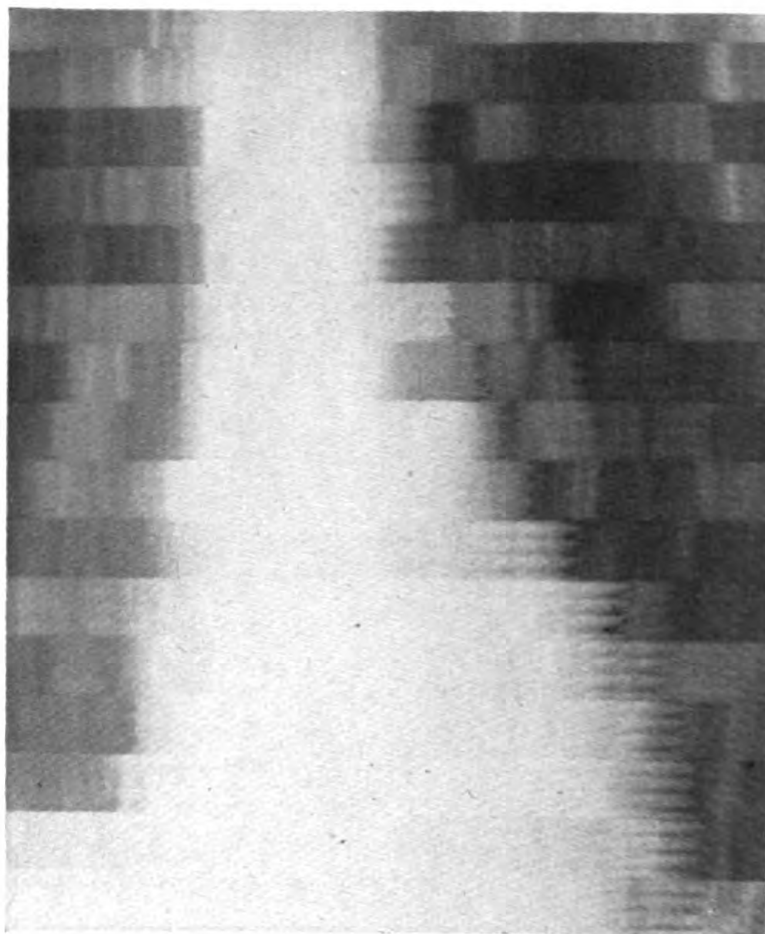
Of the four cases with definite enlargement, two showed slight and one moderate enlargement of the left ventricle; one showed slight enlargement of the right ventricle. Of the cases with questionable enlargement, one involved the left, and one the right ventricle.

Fourteen patients showed kymographic evidence of abnormal contractions. In three the amplitude of ventricular contractions was more shallow than normal. In the 14 cases mentioned above there was slight to moderate "peaking" of the ventricular waves, definitely suggestive of disordered ventricular function. The findings were graded on a basis of 1 to 4 (mild to severe peaking); 10 cases showed grade I, and 4 cases grade II changes. In all but 1 case the findings were predominately in the left ventricle (figs. 4 and 5).

COMMENT

It is therefore clear that the major clinical manifestations in these tsutsugamushi disease patients (undue fatigue, excessive dyspnea and palpitations on moderate exertion, dizziness on effort, tachycardia, abnormal pulse and symptomatic response to an exercise test, decreased breath-holding ability) are rather typical of the so-called "effort syndrome" or neurocirculatory asthenia.

This syndrome is usually seen in patients with a psychoneurotic or constitutionally inadequate background. It must be emphasized that the men discussed in this paper do not fit into any neuropsychiatric classification. They had been obviously fit and rugged persons, practically all Marines of the First Division, who had had from 1 to 2 years overseas, all with combat experience, a number of whom had gone through the entire Guadalcanal campaign with good exercise and psychologic tolerance. To a man, they deny any previous limitation of exercise tolerance prior to the onset of their acute fever. Many have had dengue fever and malaria and they

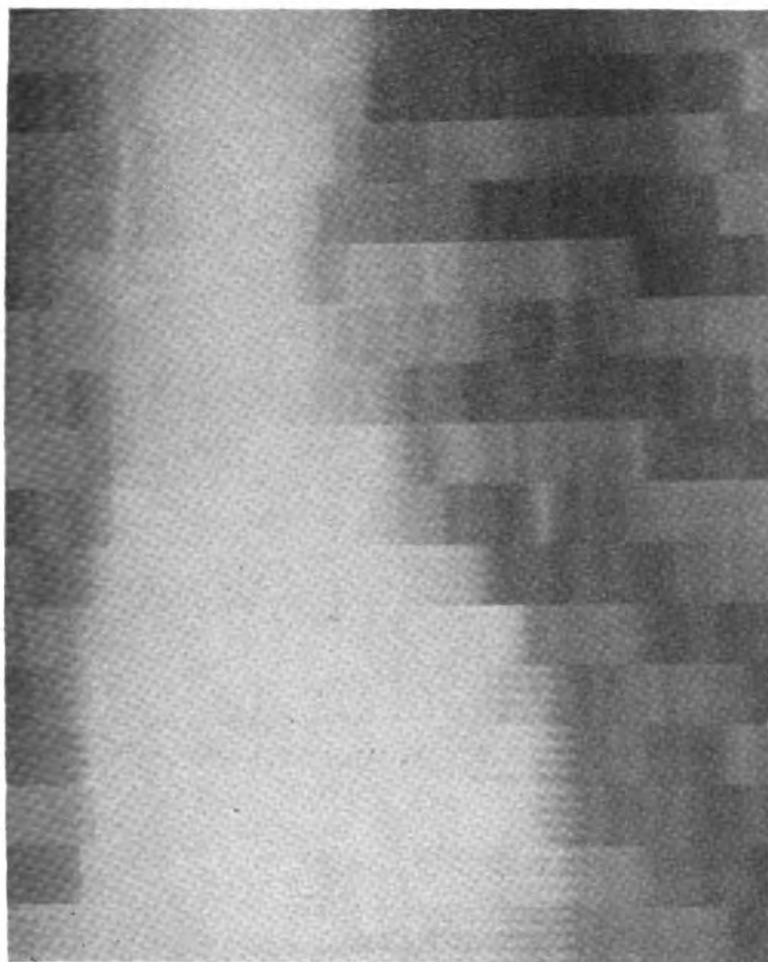


4. Cardiac roentgenkymogram (p.a., 4-foot distance) showing waves of normal amplitude and shape. This patient had tsutsugamushi disease but showed no abnormal roentgen findings during convalescence.

all attest that these diseases are very mild compared to scrub typhus. The former diseases are rarely followed by circulatory sequelae and very few patients having them complain of circulatory symptoms longer than 2 or 3 weeks after recovery.

The possibility was considered that debility from tropical duty, recurrent attacks of malaria, dysentery, and incompletely regained weight were important in the production of the circulatory sequelae noted following tsutsugamushi fever. But examination and exercise tests in many Marines returning from tropical duty who had had recurrent malaria and similar illnesses failed to demonstrate tachycardia on standing, decreased breath holding, or exaggerated symptomatic or pulse response to exercise. The majority of the convalescent tsutsugamushi patients seen here had regained practically all of the weight lost during the acute fever, often as much as 30 or 40 pounds.

The pathogenesis of these disturbances is speculative, but it is clear that the symptoms and findings are due to disturbances in function of the circulatory system. Whether these disturbances in function are of rickettsial myocarditis origin, or due to the effects of the infection on the peripheral vasomotor apparatus,



5. Cardiac roentgenkymogram (p.a., 4-foot distance) showing waves of normal amplitude but somewhat abnormal shape. The left ventricular waves show sharp peaks in diastole, instead of the normal rounded or scissors shape.

or to the effects of the disease on the cerebral medullary tissues cannot be established at this time. The possibility exists that all of these factors are of importance in the production of the symptoms and findings.

That rickettsial myocarditis could be the basis for the disturbances in function seen in the cases reported is supported by the abundant evidence that diffuse myocarditis occurs in this disease,

by the fact that the symptoms are compatible with myocarditis, and by the occasional cardiac enlargement, minor electrocardiographic changes, and the demonstrated kymographic abnormalities.

Peaking of the left ventricular waves in the kymograms seen in our cases is an interesting finding that requires further study. It has been seen in diphtheritic myocarditis and in rheumatic myocarditis, but not in normal persons or in simple tachycardia. The associated circulatory findings in these previously fit young men, the known diffuse interstitial myocarditis that occurs in the acute states of tsutsugamushi disease, and the presence of peaking of the kymograms in 40 percent of these patients suggest that such peaking may represent x-ray evidence of myocarditis. Further studies on this point are in progress.

The appearance of the rather severe vasomotor disturbances of the hands and feet is of interest and suggests the vasomotor origin of the circulatory symptoms seen in our cases. In epidemic typhus, the medulla has the maximum number of microscopic lesions of any area in the central nervous system. Since tsutsugamushi disease is characterized by similar vasculitis and perivasculitis, it is possible that small areas of petechial hemorrhages and degenerative changes in the region of the vasomotor center of the brain may be responsible for the vasomotor manifestations of these patients.

The course of the circulatory disturbances in the convalescent phase of tsutsugamushi disease has been progressively favorable, and with gradually increasing activity, all of the men were able to proceed on furlough within 90 days prior to returning to duty. The symptoms progressively improved and the pulse response to activity tended toward normal. This complete recovery after gradually increasing return to full exercise activity parallels the findings noted by Strong (14) in his studies on patients with disordered action of the heart following trench fever (now known to be a rickettsial disease) in World War I.

The possibility exists that the number of patients that have been seen with circulatory symptoms represents only a small proportion of the total number of men who develop tsutsugamushi fever; there is no information on what percentage of the total these 35 men represent.

SUMMARY

A study of the literature reveals that the typhus group of diseases produces an acute focal and diffuse myocarditis, and frequently during the acute illness, circulatory disturbances occur

that may be due either to peripheral or acute myocardial failure. Acute myocarditis has been shown histologically to occur in tsutsugamushi disease as well as in epidemic typhus. The convalescence in many cases of tsutsugamushi disease is protracted, and disabling circulatory symptoms may persist 6 months after the onset of the disease.

Thirty-five patients convalescing from tsutsugamushi disease have been studied; the average interval from the onset of the infection was 4.7 months. The predominant symptoms have been those usually attributed to effort syndrome and vasomotor instability.

Objective evidences of residual impairment of the cardiovascular system were manifested by demonstrable decrease in duration of breath holding, abnormally rapid pulse response to standing and mild exercise, by minor changes in the electrocardiogram, by occasional enlargement of the heart, as demonstrated roentgenographically, and by the presence of "peaked" waves of myocardial abnormality in the cardiac kymogram.

The pathogenesis of these disturbances is speculative, and whether they are caused by vasomotor instability, residual rickettsial myocarditis, or possibly cerebral medullary lesions is not known.

Militarily the prolonged vasomotor instability in the healthy young men who acquire tsutsugamushi disease is of great importance. They are incapacitated for full military duty for many months, and with the possibility of increased incidence of the disease in future operations, the problem of control becomes of even greater urgency.

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THIOURACIL

Thiouracil in proper dosage over a sufficient period of time will bring the metabolic rate to normal.

Thiouracil is a dangerous drug and its administration requires close supervision. Production of agranulocytosis in unsupervised cases has and will produce fatalities.

The preoperative use of thiouracil and iodine has made it possible to avoid fatalities and to eliminate multiple stage operations in the surgical treatment of toxic goiter.

Thiouracil produces most unfavorable operating conditions in the thyroid gland when administered without iodine to patients being prepared for thyroid surgery.

In a patient with hyperthyroidism who is given thiouracil until the metabolic rate is brought practically to normal and is then given iodine, the thyroid gland involutes, as does the thyroid gland in a patient with an exophthalmic goiter who has been given iodine; thus ideal operating conditions are produced, and the advantages of both thiouracil and iodine are obtained.

The appearance of agranulocytosis on continuous treatment with small doses of thiouracil is reported; the appearance of agranulocytosis seven days after the administration of thiouracil had ceased is reported, as is a fatality in a patient receiving thiouracil at home when a streptococcic sore throat was superimposed upon a beginning agranulocytosis.

Only time will prove how valuable thiouracil is in producing permanent remission in hyperthyroidism. At the present time it is our opinion that it will not produce lasting and permanent remission from toxicity.—LAHEY, F. H.: *Thiouracil*. *Surg., Gynec. & Obst.* 81: 335-336, September 1945.

TRANSPORTATION OF JAPANESE PRISONERS OF WAR

THE MEDICAL DEPARTMENT OF AN ATTACK TRANSPORT¹

The surrender of large numbers of Japanese prisoners in the forward area marked the beginning of an evacuation problem novel in the Pacific war. This ship, an attack transport, recently carried 1,034 Japanese prisoners of war from the forward area. These prisoners were aboard approximately 3 weeks. The story of the trip is submitted for what it may be worth to other ships detailed to serve as prisoner transports.

Few ships have experienced the difficulties attending the care of a thousand Oriental prisoners. Many problems had to be anticipated and met with as much imagination and ingenuity as possible. A plan had to be developed for combating the expected heavy louse infestation and other potentialities for the epidemic spread of disease. The crowded conditions aboard ship made this difficult.

We were first given a muster list of the prisoners to be received, and here arose our first difficulty. These prisoners had for the most part two sets of names. In addition, they would often answer to other similar names. The prisoners were therefore checked by number as they came aboard without attempting to identify each by name.

Prisoners were brought to the ship in small landing craft and embarked by landing net at two stations on the main deck. They were guided through a series of stations where each in turn was disrobed, inspected, shaved of all head and body hair, given soap and passed through a salt water shower which was improvised from a fire hose. Each dried himself with a towel and was then sprayed from head to foot with 10-percent DDT powder in talc. A clean pair of shorts was issued to each prisoner, together with an arm band, the color of which designated the compartment to which he was to be taken.

¹ Personnel of the medical department of the U.S.S. *Clinton* (APA-144) included the following: Lieutenant Commander John L. Barritt (MC) U.S.N.R.; Lieutenant Commander Paul H. Burke (DC) U.S.N.R. and Lieutenant William H. Eyster (MC) U.S.N.R.; Lieutenants, junior grade, Donald L. Custis (MC) U.S.N.R. and William J. Robb (MC) U.S.N.R.; Ensign Richard B. Talliaferro, Jr. (HC) U.S.N., and Chief Pharmacist's Mate William T. Davis, U.S.N.R.

Thirty-six of the prisoners were transferred to the medical department as casualties, although others (192 in all) had more or less serious wounds. The stretcher patients and those unable to climb the landing net were hoisted aboard on pallets swung in cargo nets, salmon boards not being available on this ship. They scrambled up the nets like monkeys. While one hand clutched the net, the other hand invariably clung to such meager possessions



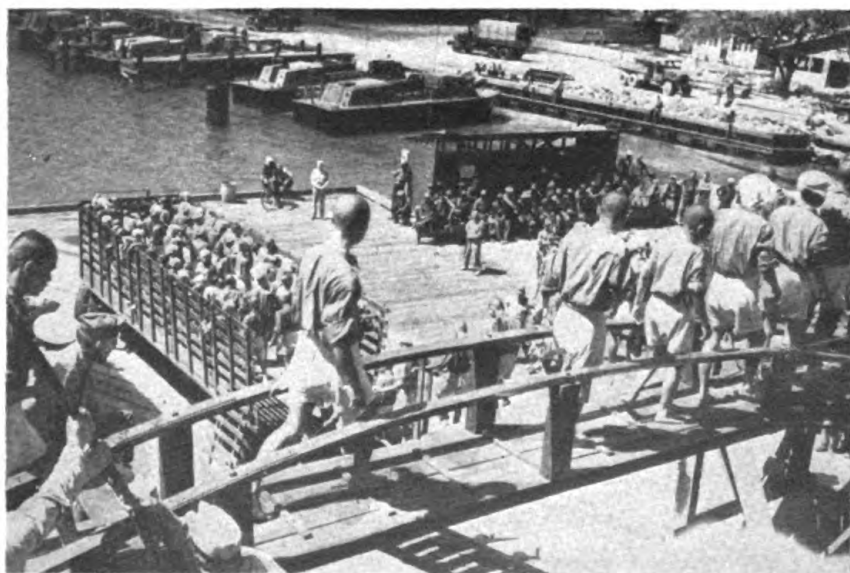
1. Prisoners of war being given preliminary examination by a medical officer.



2. Prisoners under shower, improvised from fire hose and fog nozzle. Note dressing on Jap at left, and POWs being hoisted in cargo net at right.



3. Sick call on deck.



4. Prisoners leaving ship, clad in clean shorts and shirts.

as a cookie from an Army ration, or two or three sodden cigarettes.

The prisoners were kept in locked troop berthing spaces. Guards with billies were assigned inside these spaces, and armed guards were stationed outside at all times. All prisoners were brought on deck once a day under guard, and at this time sick call was held for each group as it was brought up. Those with serious conditions were cared for as hospital patients, they too being under guard.

The wounds of the group were not remarkable. The majority were minor granulating wounds that required only simple dress-

ings. The more serious wounds were for the most part compound fractures with gross infection and toxemia. Three of these wounds were swarming with maggots, and few had had adequate treatment. The treatment employed in many cases was that of wide incision for drainage, very loose packing with vaseline gauze, and application of casts. Sulfadiazine and penicillin therapy, although intensively carried out, seemed to have little effect on these old infections. In several of the cases surgery was indicated but postponed because of the poor physical condition of the patient. These patients were given supportive treatment and penicillin in the hope that surgery could be undertaken ashore at a later date.

One of the medical officers (J. L. B.) treated a series of infected wounds by wound irrigations with acidified aqueous solutions, the object being to gain a bacteriostatic effect by an alteration of the pH of the wound. Although results appeared to be good, sufficient data is not at hand to report further on this original method of wound treatment.

A survey was made of the various wounds and illnesses in the group. Each prisoner was examined, some many times. History taking and questioning were carried out through interpreters² and proved to be quite a task. Historical data on some diseases, particularly malaria, was difficult to obtain, as would be true in any large group. However every effort was made to avoid leading questions and the figures obtained are considered to be conservative rather than otherwise.

The incidence of skin disease was found to be very high (28 percent). Approximately one-half of the cases represented various forms of fungus infection. Areas commonly involved were the inguinal and perineal regions, the lower legs, the ankles, and the forearms. It is noteworthy that these prisoners had no fungus infection of the toes, a condition which occurs so commonly among American personnel in the Pacific area. Heat rash and furunculosis constituted a large part of the remainder of the skin diseases. Both conditions increased in number during the stay aboard ship.

Initially the prisoners complained of few respiratory infections. Under the conditions of extreme heat, high humidity and intimate contact, the incidence of these infections increased. Isolation of such patients was impossible because of the crowded conditions aboard. Two cases of rapidly developing bronchopneumonia took origin from apparently mild common colds and led to the belief that the prisoners possessed a relatively low immunity to the organisms present among American personnel aboard. This implies

² We wish to express our appreciation to Lieutenant Donald L. Keene, U.S.N.R., for his invaluable assistance in obtaining much of the information.

the advisability of preventing contact of ship's crew with prisoners as much as possible.

Fifteen cases of active malaria occurred and these patients were placed on routine atabrine therapy with good results. Two hundred ninety patients were found in whom questioning brought out a history of malaria.

Sixty-nine of the group complained of gastro-intestinal symptoms. Most of these were diarrheas; a few had bloody stools. Onset of symptoms in this group occurred prior to their coming aboard, as an epidemic of diarrhea was present ashore, associated with a high incidence of parasitic infection. Careful washing and sterilizing of dishes and silverware was carried out.

The prisoners were for the most part well-nourished. Thirty-one, or about 3 percent, had definite cases of malnutrition. We had been told by those who had supervised the feeding of Jap prisoners ashore that ordinary Army and Navy rations would cause gastro-intestinal upsets, no doubt because of their relatively high fat content. This was borne out in the experience here, and for the most part a diet of rice, supplemented by stews of beef, pork, lamb, and vegetables was used. These prisoners seemed very content with this ration. They considered bread a luxury item and they asked that it be added to their diet.

Since most of the prisoners came from areas where filariasis was endemic, it was expected that a high incidence of this disease would be found. No laboratory studies of the disease were made, but 16 prisoners, or 1.4 percent, showed very definite clinical manifestations. The cases represented a somewhat late stage with chylocele, chronic lymphadenopathy, and mild elephantiasis of the scrotum. There were no demonstrable acute flareups while aboard.

There was one case of acute gonorrheal urethritis that cleared upon administration of sulfathiazole therapy. Blood Wassermann tests were not done on the group, neither were darkfield examinations nor Frei tests made. A clinical inspection for venereal disease was carried out, and 70 penile lesions were found. These varied from small, indurated, poorly demarcated papules to well-defined, indurated ulcers. In one group of 529, eleven had an associated skin lesion. Most of these men admitted a history of syphilis.

There were several cases of hysteria; one was a functional "lockjaw," and several were syncopes. As a group the prisoners were extremely docile and displayed complete trust in the medical personnel. Some, however, were anxious and ill at ease when given treatment away from their fellows. There was no case of attempted suicide.

In 449, or 42 percent, of the prisoners, examination failed to reveal significant medical or surgical disorders. The rest of the cases not described were such conditions as otitis media, eye infections, benign tumors, and various structural abnormalities.

Dental examination was made on 545 of the prisoners. The examination was necessarily brief because of the time element concerned. Of those examined, the percentages of the various conditions found were as follows:

<i>Condition</i>	<i>Percent</i>
1. Teeth missing (1 to 23).....	23
2. Extractions needed (1 to 8).....	15
3. Residual roots (1 to 14).....	31
4. Large cavities	17
5. Pyorrhea alveolaris	19
6. Gingivitis	23
7. Vincent's infection	2
8. Prophylaxis needed (only).....	12
9. Teeth considered fair.....	7
10. Teeth considered good.....	2

Nearly all restorations were bridges or crowns, 8 percent having gold bridges and 3 percent combination metal. One man had full upper and lower dentures and four had partials. In summary, the prisoners had had little if any dental care while in the Army and their own efforts toward a sanitary mouth had been practically nil. The 31 percent having residual roots probably best emphasizes the deplorable lack of dental care.

Relative incidence of more common diseases among 1,034 Oriental prisoners of war

Medical or surgical condition	Number of cases	Percentage
Wounds	192	19
Skin diseases	289	28
a. Fungus infections	124	12
b. Heat rash	89	8
c. Furunculosis	42	4
d. Miscellaneous	33	3
Malaria (active)	15	1.5
Malaria (inactive)	290	28
Gastro-intestinal disorders	69	7
Malnutrition	31	3
Filariasis (clinical)	16	1.4
Penile lesions	70	7
Normal (no apparent pathosis)	449	42

The medical records required on prisoner-of-war casualties do not vary greatly from the procedures applicable to our own armed forces. In accordance with the Geneva Conference, only the name, rate, and service or serial number is required.

In closing the records of deceased prisoners of war, NAVMED Forms N and 601, F and Fa should be completed and forwarded

to the Bureau of Medicine and Surgery. Forms F and Fa should be prepared on all POW patients as a matter of record. Form H-8 should be prepared and transferred with the patient. All x-ray film should be transferred with the patient. Extreme caution must be exercised in regard to POW names and an interpreter called in case of doubt.

Almost universal confusion existed as to the purposes and use of the various toilet facilities aboard ship, and many humorous situations developed. Instruction cards written in Japanese were posted in the heads explaining the use of the various facilities. Few required instruction or encouragement in the use of showers. Some, however, preferred to bathe themselves from the lavatories rather than use the showers.

SUMMARY AND CONCLUSIONS

The transportation of 1,034 Japanese prisoners of war involved a multitude of problems.

1. A thorough program of inspection, shaving, washing, and the use of DDT powder is necessary. No lice were found after the use of this routine.

2. Muster lists received with prisoners must be regarded with suspicion, as phonetic spelling and the great similarity of names make errors easy.

3. It was found necessary for an interpreter to make regular rounds for the purpose of ferreting out early cases of illness. The Japanese prisoners seemed reluctant to report cases of illness among their friends and disliked even more to administer to them.

4. A diet high in carbohydrates seems to agree best with the prisoners. They seemed unable to tolerate even a moderately high fat content. Feeding over a long period would need careful consideration.

5. Discipline of the prisoners was not a problem in our experience.

6. In the handling of serious casualties, much time is consumed in interpretation, and for this reason few patients can be cared for.

7. If possible efforts should be made to avoid loading to peak capacity, as complications arise due to crowding which are hard to control.

There were three deaths in the group; two from bronchopneumonia of a fulminating type following apparently minor upper respiratory infection. The third death occurred in a patient who came aboard in extreme emaciation and with diarrhea. No specific organisms were found.

MANAGEMENT OF INJURIES OF MAJOR BLOOD VESSELS

GEORGE CRILE, JR.

Lieutenant Commander (MC) U.S.N.R.

Among the conditions the military surgeon may be called upon to handle are secondary hemorrhage, pulsating hematoma, and circulatory disturbances following injury to blood vessels and arteriovenous fistula.

Secondary hemorrhage.—Ligation of a vessel as large as the femoral, when conducted in an infected field, is usually doomed to failure. After 3 or 4 days the ligature is cast off the artery, and bleeding recurs. Packing does not often control hemorrhage for more than a few hours. Application of hemostats and removing them after 72 hours without ligation of the vessel may control the bleeding in a clean wound, but if infection is present, the bleeding will recur. Whenever possible the vessel should be ligated through a separate incision in a clean field. But the point at which the vessel is to be ligated should be no higher than is necessary to avoid contamination. If the ligature is placed too high, valuable collateral circulation may be cut off. When bleeding from the infected wound persists or recurs after proximal ligation of the main vessel through a separate incision, it is the distal end of the main vessel which is bleeding by means of its collateral anastomoses. Because the pressure in the distal end of the vessel is low, simple ligation of the distal stump in the infected field permanently controls the bleeding.

Communicating arterial hematoma (pulsating hematoma).—When the wall of a vessel is not completely severed by a small projectile but has an opening on one side which is held apart by elasticity of the vessel, blood escapes into the tissues. Clots block the wound of entry, and a pulsating hematoma is soon formed. The wound of entry heals, and a hematoma remains which communicates with the artery. Clinically, this manifests itself by a tense mass which, if located superficially, has an expansile pulsation over which a systolic bruit frequently can be heard. It is differentiated from an arteriovenous aneurysm by a bruit which is audible only in the systolic phase and by absence of the circulatory symptoms attending an arteriovenous fistula. Occasionally when the hematoma is located deep under the muscles and fascia

and when the opening in the vessel is small, there is neither bruit nor pulsation; the diagnosis is established by inserting a needle and obtaining bright red arterial blood.

Pulsating hematomas are under full arterial pressure and gradually enlarge until they rupture spontaneously through the skin, usually at the site of the wound of entry. The defect must be repaired before a severe secondary hemorrhage occurs. The treatment of choice is ligation of the vessel above and below the point of injury, division of the artery and ligation of its accompanying vein. Bleeding should be controlled by application of a tourniquet proximal to the lesion. If this is impossible it is best to place a tape around the vessel through a separate proximal incision and apply a tourniquet distal to the bleeding point to control reflux hemorrhage from the distal end of the vessel. The sacs of the false aneurysms need not be excised. It suffices merely to obliterate the cavity with a few sutures or with very light pressure.

Reconstruction of a vessel is rarely feasible because the openings are usually large, and repair frequently is followed by thrombosis or the development of a true aneurysm. In fresh, clean wounds, located where ligation of the vessel entails an unusual hazard, reconstruction of the vessel may be attempted. But ligation and division of the artery and its accompanying vein is usually the treatment of choice.

When large vessels are ligated, secondary hemorrhage may occur. The blood supply of the stump distal to the ligature is cut off by the ligature and hence the stump undergoes necrosis and sloughs away. No tissue is then left to secure the ligature and the force of the pulsation is apt to throw it off.

Secure healing of the stump of a vessel is obtained not so much by the union of the tissues of the vessel itself as by the healing of the tissues around the stump. When the stump and the ligature slough off, nothing is left to check the bleeding except the adhesions between the walls of the vessel. If these are not supported by firm union of the surrounding tissues over the stump, there may be a recurrence of the bleeding. For this reason the stump should be: (1) Short so that no excess necrotic tissue is present; (2) ligated with a nonirritating, nonabsorbable ligature; and (3) tucked into or under normal tissues with good blood supply and healing powers so that they will unite firmly over it. Every effort should be made to avoid contamination of the wound.

If the wound of entry is still unhealed, contamination is surely present. If operation cannot be delayed with safety until this wound is securely healed, the dirty wound should be walled off and the hematoma approached through a clean, separate incision.

The interior of the hematoma is always clean and uncontaminated, and if it can be entered without traversing the superficial part of the old wound, the danger of secondary hemorrhage due to infection is avoided.

When vessels are ligated in continuity, the tendency to secondary hemorrhage is greatly increased. Ligation in continuity may be permissible as Love¹ suggests, when a common carotid artery is to be ligated. If hemiplegia occurs the ligature can be removed several hours later and recovery will follow. But in such cases it would seem that it would be safer to close the wound loosely, and if no signs of circulatory failure developed, to reopen it, ligate the vessel again and divide it. If the operation is done under regional anesthesia, the circulation of the brain can be evaluated without delay.

Circulatory disturbances following injury of blood vessels.—Damage to the great vessels, even in young people, may cause gangrene of an extremity, but it is rare for this complication to occur except (1) when the wound is large, and when much muscle and many collateral vessels are destroyed, (2) when severe infection and swelling interfere with collateral circulation, (3) when the popliteal artery is severed, and (4) when arterial disease is present. Since most communicating arterial hematomas which occur in healthy young persons are caused by small projectiles, and since few are infected, maintenance of adequate circulation is not often a problem. Yet occasionally, when one least expects it, ligation of a major vessel will be followed by the tragic complication of gangrene of an extremity.

It has never been clearly established why certain patients fail to maintain adequate circulation after ligation of a major vessel. It is possible that in these individuals there are anomalies of the vascular system which fail to provide an adequate collateral circulation. But this fact is difficult to establish before operation. When pressure is applied to a vessel manually or by an Ochsner's clamp applied externally, the circulation may appear to be adequate, yet following ligation of the vessel, signs of severe circulatory deficiency may ensue. It is, therefore, reasonable to assume that the failure to establish collateral circulation is dependent at least in part upon arterial spasm.

The factors that produce arterial spasm are poorly understood and the efficacy of measures for its relief are difficult to evaluate. Arterial tone is apparently dependent to some degree upon autonomous mechanisms in the wall of the vessels as well as upon reflexes mediated through the sympathetic nervous system. Thus

¹ LOVE, J. G., and HORTON, B. T.: Paralysis of ulnar nerve due to arteriovenous fistula. Proc. Staff Meet., Mayo Clin. 19: 441-444, August 23, 1944.

injection of procaine hydrochloride into the lumbar sympathetic ganglia is not always effective in producing the desired vasodilatation. Other measures, such as the administration of an ounce or more of whiskey every 4 hours and the application of a heat-cradle over the body (with the affected extremity outside), should be used.

The injections of the ganglia should be repeated daily, transfusions should be given if the hemoglobin content of the blood is below normal, the blood pressure should be maintained following the operation, and 100-percent oxygen should be given by the BLB mask. If the weather is hot the affected extremity should be kept cool so that its metabolism will be low and its chance of survival increased. It is doubtful whether actual refrigeration of the extremity is of value except as a means of deferring amputation until a more favorable time. The use of mechanical devices to produce alternate positive and negative pressure has not, in my experience, been effective. Smoking should be prohibited.

Despite the use of any or all of the aforementioned measures there will be an occasional patient in whom there is no response and in whom gangrene of the extremity ensues. It is often obvious from the very first that this will occur. The foot appears pale and cyanotic from the time of operation, the extremity becomes cold, and the patient usually complains of pain. Paralysis and anesthesia may be present. When these findings are noted from the beginning, treatment is usually doomed to failure, and in spite of all therapy, amputation will often be necessary.

If facilities are available for refrigerating an extremity, impending circulatory gangrene resulting from extensive destruction of soft tissues and blood vessels can be treated for several weeks by conservative means. During this time collateral circulation develops and the line of demarcation may be considerably lower than was initially expected. By keeping the gangrenous portion in ice, infection can be retarded or prevented until collateral circulation of the viable portion permits good healing after amputation. The gangrenous portion must be examined frequently for signs of infection. Threatened gangrene should never be treated by application of heat to the affected limb, as this increases the metabolism of the tissues, causes their death, and increases the propagation rate of bacteria.

Arteriovenous fistula.—Repair of an arteriovenous fistula is not an emergency procedure. Unlike communicating arterial hematomas in which the sac expands under tension of full arterial pressure, the blood in an arteriovenous fistula is under low pressure and hence the aneurysm does not tend to rupture externally.

The pressure is shunted into the veins and the only complications are chronic circulatory disturbances in the extremity and overburdening of the myocardium.

Since the blood pressure in the extremity is low as a result of deflection of arterial blood into venous channels, collateral circulation soon develops. Although most aneurysms could be corrected immediately by quadruple ligation of the vessels, it is wise to wait 3 or 4 months until collateral circulation has developed beyond the point of slightest question.

Vein grafts.—Despite the fact that ligation of major vessels often can be performed without causing serious impairment of the circulation, it is true, particularly in the case of injuries of the lower extremities, that on rare and unpredictable occasions, ligation of the femoral artery will be followed by gangrene. The same is more often true in the case of the popliteal vessels.

Even in those cases in which there is little gross evidence of circulatory impairment, physiologic impairment is the rule. Few patients, following ligation of either femoral or popliteal vessels, can walk for long distances without experiencing claudication due to deficient circulation in the muscles of the lower leg. For these reasons, the development by Blakemore and his coworkers,² of a nonsuture method of blood vessel anastomosis, using an autograft of a vein held in place by vitallium cuffs, has been a distinct contribution to vascular surgery. Even if the graft eventually thromboses, its patency, maintained by heparin during the first few days after operation, will tide the patient over the critical period of vasospasm and edema.

We have had occasion to utilize this method in two cases of arteriovenous aneurysm of the popliteal artery, and although sufficient time has not yet elapsed to evaluate the final result, the dorsalis pedis pulse of both patients is normal. In one of these cases the collateral circulation was so poor that the leg probably would have been lost had the artery been ligated.

SUMMARY

1. The management of secondary hemorrhage, pulsating hematoma, arteriovenous fistula, and circulatory disturbances following ligation of major vessels are discussed.

2. The use of vein grafts to bridge arterial defects, as reported by Blakemore et al., is advocated in cases in which ligation of an artery may result in serious impairment of circulation.

² BLAKEMORE, A. H.; LORD, J. W., JR., and STEFKO, P. L.: Restoration of blood flow in damaged arteries: further studies on a nonsuture method of blood vessel anastomosis. *Ann. Surg.* 117: 481-497, April 1943.

PERINEPHRIC ABSCESS

REPORT OF THREE CASES SIMULATING ACUTE APPENDICITIS

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and
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Although perinephric abscess is one of the less common causes of abdominal pain, it should be considered in the differential diagnosis of any abdominal pain. An injudicious appendectomy in the presence of a perinephric infection may be deleterious. The disease is so protean in manifestation that these three cases which simulated appendicitis were considered to be worth reporting. The syndrome of obscure fever with pain in the right flank and abdomen, due to a perinephric infection, may be easily confused with acute appendicitis.

CASE REPORTS

Case 1.—The patient, a 30-year-old fireman, was admitted to the dispensary on 30 November 1943 with a history of severe pain of 2 days' duration in the right lower quadrant of the abdomen. The pain was described as beginning in the right lower part of the abdomen and radiating through to the back, and of sufficient severity to cause the patient to double up. There was an associated nausea but no vomiting, and no urinary symptoms or change in bowel habits.

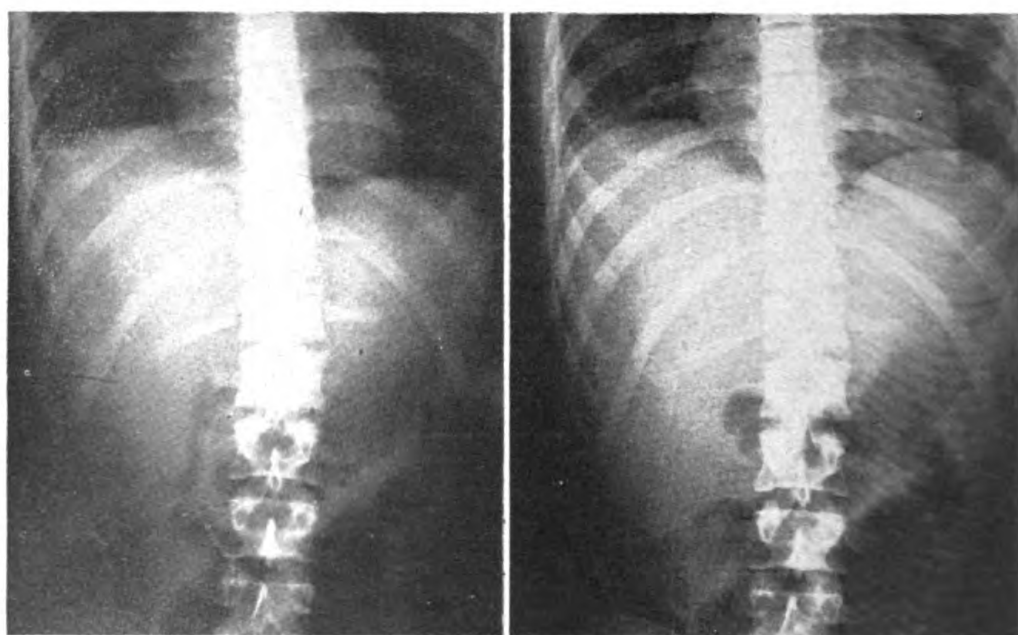
The patient was robust and well-developed. Examination of the abdomen revealed moderate right lower quadrant tenderness, with an extension of this tenderness into the right flank and the right costovertebral angle. There was no muscle spasm and no mass was palpable. Rectal examination was negative. Blood count showed 12,600 leukocytes, with 74 percent segmented cells, 5 percent band forms, 18 percent lymphocytes, and 3 percent monocytes. The urine was normal.

On the following day, pain was still present, the temperature was 99.8° F., tenderness extended well into the right flank, and there was an elevation of the leukocyte count to 17,400. The urine was still normal. Two days later, because of a very severe colicky type of pain in the right side, simulating ureteral colic, a No. 6 French ureteral catheter was passed to the right renal pelvis, and a retrograde pyelogram was made. This showed a normally functioning kidney, with clear urine which was microscopically negative. The patient's temperature was elevated to 102° F. and the pulse rate to 118 following these procedures.

The next day (4 December), the temperature was 101° F., the leukocytes

numbered 20,550 per cu. mm. of blood, with 89 percent neutrophils; and the urine contained albumin 1-plus with numerous erythrocytes and occasional leukocytes in the sediment. Sulfathiazole, 1 gm. every 4 hours, was given. Between 4 December and 9 December, the patient continued to have a fever ranging between 100° and 101° Fahrenheit. The leukocyte count gradually decreased to 16,000; the urine was normal except for an occasional erythrocyte.

On 10 December the patient complained of more severe pain in the right side with maximum localization in the region of the right kidney. On a flat-plate roentgenogram of the kidneys, ureter, and bladder, both renal shadows were faintly visualized; the right psoas shadow was somewhat indefinite, and there was no evidence of calculi. These findings were considered essentially negative.



1. Case 1. Roentgenograph taken on inspiration, showing evidence of elevation of the right diaphragm, obliteration of the psoas shadow, and scoliosis.

2. Roentgenograph taken on expiration, showing fixed, elevated diaphragm with lack of excursion on the right side.

In the next 2 days the patient's temperature ranged between 100° and 102° F.; the pulse rate between 90 and 100 beats per minute; and the leukocyte count rose to 19,400, with 91 percent neutrophils. At this time the patient had a definite induration and sense of resistance extending from the right costovertebral angle to the right flank. He was given a transfusion of citrated blood, and another x-ray examination was made of the kidneys, ureter, and bladder (figs. 1 and 2). One roentgenograph was taken on inspiration and one on expiration. A high, fixed diaphragm, obliteration of the psoas shadow, scoliosis of the lumbar spine, and intestinal displacement were well shown.

On 12 December drainage was obtained through a 12-cm. right flank incision. The kidney and perinephrium were involved in an ill-defined mass of

inflammatory tissue. The soft tissues were extremely vascular, friable, and edematous. No frank pus was encountered. Sulfanilamide was dusted into the wound, and two Penrose drains were inserted, one to the upper pole of the kidney and the other along the lower border of the psoas muscle. The incision was closed loosely around the drains.

3. Case 1. Intravenous pyelogram taken before patient's discharge to duty. Interpreted as being within normal limits.



The patient's convalescence was uneventful except that on the fifth post-operative day he developed a transient nonproductive cough. On 1 February 1944, prior to return to duty, an intravenous pyelogram showed normal functioning kidneys and normal renal calices and pelvis (fig. 3).

Case 2.—A seaman, second class, 22 years of age, was admitted on 24 September 1943 complaining of pain of about 5 weeks' duration in the abdomen and right flank. He had lost 30 pounds in weight during that time. The patient had been well and active until about 5 weeks before admission when, following a fall down a ladder aboard ship, he had transient mid-back pain. Ten days after the fall he reported to sick call complaining of pain in the abdomen. He was found to have an elevated temperature (99.2° F.), tenderness in the flank and right lower quadrant of the abdomen, and an elevated white blood cell count (18,500). An appendectomy was performed aboard the ship, with removal of a grossly normal appendix, but milky fluid was noted in the abdominal cavity; the fluid was negative on culture.

Following appendectomy, the patient continued to have pain in the abdomen, right flank and back, and the temperature and leukocyte count continued to be elevated. A flat-plate roentgenogram of the abdomen showed essentially negative findings, but fusion of bodies of the first and second lumbar vertebrae was noted, which was interpreted as suggestive of an old tuberculosis of the lumbar spine. An intravenous pyelogram taken aboard ship yielded negative findings. The pain in the right flank and back, however, became more intense and interfered with walking. There were no gastro-intestinal symptoms except anorexia, and there were no urinary symptoms.

The patient was transferred to a Naval shore hospital for further study and treatment. The past history revealed that 6 years previously he had been treated for 3 months in a civilian hospital following a vertebral injury sustained while playing baseball. Convalescence was uneventful, and following discharge from the hospital he was entirely well and active. The family history revealed no tuberculosis, syphilis or any known familial diseases.

On admission examination at the hospital, the temperature was 100.8° F., pulse rate 98, and respirations 24 per minute. The patient appeared well-developed but poorly nourished, with evidence of recent weight loss. Abdominal examination showed a well-healed McBurney scar with exquisite tenderness in the right flank and right costovertebral region. There was slight tenderness over the first and second lumbar vertebrae. Pain was experienced in the right side of the abdomen and the flank on right straight leg raising. There was a negative psoas sign on the left side. Rectal examination yielded negative results. The urine was normal. The erythrocyte count was 3,630,000 and the leukocyte count 18,850.

X-ray examination of the lumbar spine revealed a fusion of the bodies of the first and second vertebrae. The bodies themselves did not show evidence of any pathologic process. There was some irregularity of the inferior surface of the second vertebra on the right side, suggestive of an old fracture. An intravenous pyelogram showed that the iliopsoas borders were not visualized on either side. Five minutes following the injection, the dye appeared in adequate concentration in both kidneys. The right kidney shadow appeared normal in size, shape and position. The outline of the left kidney could not be visualized because of intestinal gas present. The right kidney pelvis and calices presented no abnormalities. A bifid ureter was shown on the left side. There was no evidence of obstruction along the course of either ureter.

On 1 October (7 days after admission) an 8-inch oblique posterolateral incision was made over the right kidney area and an abscess cavity encountered beneath Gerota's capsule. An extensive perinephric abscess was opened, extending from the upper pole of the kidney downward along the posterolateral border of the right psoas muscles, as far down as the finger could reach. The kidney was firm and of average size and consistency. The transverse processes of the lumbar vertebrae were easily felt, but no exposed bone was palpable. Two Penrose drains were inserted, one to the upper pole of the kidney and the other into the lower depth of the abscess cavity, and the wound was closed loosely around the drains. Sulfanilamide, 5 gm., was sprinkled into the wound before closure. Culture of the wound exudate showed abundant growth of *Staphylococcus aureus*.

The patient's convalescence was prolonged but uneventful. The temperature which had been spiking before operation became normal within a few days. On 19 November an intravenous pyelogram showed essentially negative findings except for a bifid ureter on the left side. The urine was consistently normal. The patient was discharged to full duty on 4 December; he had gained 10 pounds since operation.

Case 3.—A seaman, second class, 18 years of age, was admitted to the dispensary on 22 November 1943 with a history of pain in the right lower quadrant of the abdomen. The pain was intermittent in character over a period of 3 weeks, but had become more severe and persistent a few days prior to admission, radiating to the right testis, and being associated with nausea, chills, and burning and frequency of urination.

The patient was a tall, thin man with a scaphoid abdomen. His temperature was 100.8° F., pulse rate 88, and respirations were 20 per minute. There was moderate tenderness in the right lower quadrant of the abdomen and in the right costovertebral angle. There was no muscle spasm, and no palpable mass. No abnormality was found on examination of the rectum. The leukocyte count was 27,600, with 74 percent segmented neutrophils, 7 percent band forms, 14 percent lymphocytes and 5 percent monocytes. Urinalysis showed 1-plus albumin, with from 10 to 15 red blood cells per high-power field.

Two days later cystoscopy showed moderate trigonitis of the vesical mucosa and mucopurulent material floating free in the bladder. The ureteral orifices were normal in appearance and spurts of clear urine were seen coming from each at normal intervals. A No. 5 French ureteral catheter was easily passed to the right kidney pelvis. The urine from the right kidney was clear and negative on examination. Retrograde pyelograms showed evidence of good filling of the right renal pelvis and calices, with questionable dilatation of the ureter in the region of the fifth lumbar vertebra, where it was 1 cm. wide. There was no definite evidence of calculi. The impression was ureterectasis on the right side and slight caliectasis.

On the following day the patient appeared to be very ill; his temperature was 103.4° F., pulse rate 112 and respirations 24 per minute. The chief complaint was still right lower abdominal pain, but now the tenderness in the right costovertebral angle was very definite and extended well into the right flank. There was a sense of resistance not previously felt in this area. Urinalysis yielded essentially negative results. The leukocyte count was 28,100. No scoliosis of the lumbar spine, obliteration of the psoas shadow or fixation of the diaphragm could be seen on a roentgenograph of the kidney, ureters, and bladder. The elevated temperature and accelerated pulse continued and 2 days later sulfadiazine was administered by mouth in doses of 1 gm. every 4 hours.

On 30 November, flat-plate roentgenographs of the abdomen were made on inspiration and on expiration, and showed evidence of an elevated, fixed diaphragm, and obliteration and medial displacement of the bowel. The following day operation was performed through a lumbar incision. The muscle tissue was thickened and edematous. The kidney, perinephrium, posterior muscles, and anterior peritoneum were agglutinated en masse. A line of cleavage was found between the kidney and peritoneum, so that on following the plane of cleavage by blunt dissection, it was possible completely to free the kidney. There was no frank pus. Cultures were taken but these were later reported as negative. Penrose drains were inserted to the superior and inferior poles and anterior to the kidney, and the incision was closed loosely around the three drains.

There was an immediate and precipitous fall in temperature and the patient made an uneventful recovery. He was discharged to duty on 17 January 1944, after an intravenous pyelogram had yielded essentially negative findings.

COMMENT

As the name implies, perinephric abscess is an infection outside of the kidney capsule, with resultant necrosis of the perirenal connective tissue and suppuration in the renal fossa. The three cases presented were probably in the class of simple perinephric abscess, in contrast to the complicated abscesses which occur in associa-

tion with pathologic changes in the kidney. However there is no unanimity of opinion among authorities (1) (2) as to whether all perinephric infections are secondary to some infection in the kidney.

The clinical picture of simple perinephric abscess may simulate acute appendicitis, and with no urinary abnormalities (as in the three cases reported), an abdominal exploration might be undertaken. The history may reveal a skin infection or severe upper respiratory infection several days or even weeks before the onset of the first symptoms (1) (3). No such history was elicited in these three cases, although it was noted that a severe trauma to the back occurred prior to the onset of symptoms in case two.

Anorexia, easy fatigability, and night sweating are common early complaints. A history of chills and fever is also common. However pain is usually the earliest specific complaint. Pain is usually in the right flank and radiates into the costovertebral angle and to either of the upper or lower quadrants of the abdomen. The three patients in this report who had an abscess on the right side complained of pain in the flank radiating into the right lower part of the abdomen. According to Simeone (3), lesions which involve the perinephrium anteriorly, cause pain localized in the right lower abdominal quadrant. In 16 of the 117 cases reported by Atcheson there was lower abdominal pain as a presenting complaint, and in 8 of the 16 there was an associated abdominal rigidity. He emphasized that in many cases confusion arises in the differential diagnosis between this retroperitoneal lesion and acute suppurative appendicitis. Urinary symptoms are uncommon in cases of simple perinephric abscess.

On physical examination the patients appear acutely ill, and they may show evidence of weight loss if the disease is prolonged. The tenderness is most commonly found in the right flank, but in 2 out of the 34 cases reported by Simeone, tenderness was present only in the right lower quadrant of the abdomen. Spasm and visible swelling in the flank are often present. Scoliosis with concavity toward the affected side (fig. 1) due to spasm of the paravertebral muscles has been emphasized as a prominent sign of perinephric abscess. The proximity of the psoas muscle to the perinephrium renders it subject to involvement by inflammation about the kidney. In case 2 the patient held the right hip flexed almost 90 degrees at rest, and excruciating pain was experienced on active or passive extension of the hip.

Positive x-ray findings are helpful in making the diagnosis, but too much emphasis should not be placed on negative roentgenographic findings. Of the cases reported by Atcheson, 45 percent

showed positive signs in the roentgenographs. These signs in the order of frequency were obliteration of the psoas shadow, enlargement of the kidney shadow, concavity of the spine toward the side of the lesion, decreased movement of the kidney and diaphragm on respiration, and displacement or distortion of the kidney or ureters.

The urine is usually normal in simple perinephric abscess, except in those patients who have some kidney abnormality. In cases of simple perinephric abscess the presence of albumin and white blood cells in the urine indicate gross involvement of the kidney itself (3) (4). *Staphylococcus aureus* is the most frequent organism found on culture from simple perinephric abscess, while *Escherichia coli* holds comparable position in complicated perinephric abscess secondary to renal calculus and infection. The negative cultures reported in cases 1 and 2 may be attributable to the chemotherapy which had been instituted 8 and 4 days, respectively, before operation.

The treatment of simple perinephric abscess is prompt incision and drainage, which leads to a dramatic cessation of symptoms. In complicated perinephric abscess, a primary or secondary nephrectomy may be necessary. The diagnosis is not commonly made until the disease is far advanced. In the three cases reported here, 12, 7, and 8 days intervened between admission and date of operation.

The mortality was nil in the reported cases (1) (4) of simple perinephric abscess. However the mortality rate as reported may be as high as from 14 to 50 percent in complicated perinephric abscess.

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RECURRENT INDIRECT HERNIA

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During the war, hernia became an increasingly important problem in the Navy as the cause of lost man-days. In peacetime, routine examinations for enlistment or enrollment screened out all applicants with hernia except those who had had an adequate repair. But the relaxation of the standards of fitness for induction has necessitated thousands of operations in the service which otherwise would have been done in civilian hospitals or not done at all. Many veterans are desirous of obtaining employment in shipyards and factories, which may not accept employees with hernia because of the fact that insurance companies will not insure or compensate employers for loss of time or for the expense of operative treatment of employees with hernia.

The number of recurrences is in direct proportion to the number of operations for this condition. When the many factors involving both the patient and the surgeon are considered, it is realized that cures cannot be attained in one hundred percent of these patients. The fact remains, however, that the percentage of recurrences is far too high.

It is the purpose of this paper to discuss the cases of recurrent hernia that have been admitted to the U. S. Naval Hospital at Long Beach since its inception. The study is made with the object of discovering the causes of the recurrences in order that they may be prevented in the future. Inasmuch as all of these patients were operated on originally for the indirect type of inguinal hernia, this type only will be considered.

In a small town, not only the surgeon and patient but also the friends and neighbors are aware of any recurrence of a hernia or of any other operative failure. In large cities and in the service, where shifting population and rapid turnover of personnel occur, the surgeon usually never knows of his own failures. Stein and Casten (1) suggest that a clearinghouse for hernia recurrences be set up by some organization, such as the American College of Surgeons, so that each man could be notified of his recurrences.

On the other hand, in the Bureau of Medicine and Surgery is a potential clearinghouse for the reporting of recurrences of all

types of cases occurring in the Navy, not only of hernia, but of pilonidal cysts, and other potentially recurrent conditions. The suggestion has been made that a card be sent from the Bureau to every surgeon whose patient requires a second operation. Timmes (2) outlines a procedure of a follow-up report to the Bureau, which could be adapted to this suggestion. This would help each surgeon to evaluate his own work. It would not necessarily be a condemnation, as the more technically skilled attempt cases that are more difficult and therefore more likely to recur.

In connection with this clearinghouse, statistics could be garnered which would be of use in deciding various controversial subjects, such as type of suture material most desirable, optimum number of days in bed and of convalescence, and the kind of operation most suitable for the various types of cases.

Sixty-five patients with recurrent indirect inguinal hernias have been admitted to the U. S. Naval Hospital at Long Beach. These were distributed as follows: Twenty right, 15 left, 14 bilateral in whom both sides were repaired at the same time, and 12 bilateral in whom both sides were done at different times. The 65 cases represent a total of 132 herniotomies.

If one may draw conclusions from such a small number of cases, it shows that a person with bilateral hernia is more likely to have a recurrence than one with one side only involved, whether the two sides are done separately or both at the same time. He has twice the opportunity to have a recurrence, but many of these had bilateral recurrences (table 1).

TABLE 1.—Data on 65 recurrent hernias

Place of operation	Number	Type of original operation	Number	Location of recurrence	Number
U. S. Naval hospitals . . .	34	Bassini or some modification	55	(Indirect) internal ring	38
Civilian hospitals	27	Ferguson	5	(Direct) floor	15
Veterans' hospitals	4	Halsted	2	(Pantaloons) mixed	8
		Andrews	3	Femoral	2
				Sliding	2

The average number of days in bed, based on 45 known cases, was 18.2. Two of these patients were in bed 70 days, one because of an infected wound and the other a complicating pneumonia. If these are not counted, the average bed stay for 43 patients was 15.6 days. Even this number gives a high average because of several 28-day and 21-day cases. However the length of time in bed did not seem to be an important factor relating to the cause of recurrence.

The average number of months before there was a recurrence was thirty. Fifteen cases were known to have recurred before leav-

ing the hospital. Iason (3) states that 65 percent of the recurrences occur in the first 6 months. It has also been said that a large percentage occur in the first month. That is borne out by the fact that 15 out of the 65 patients had a recurrence before leaving the hospital.

Many writers in discussing this topic have given various reasons for the failures:

Patrick (4) lists the following causes of recurrence: (1) Incompetent, inefficient, or inadequate handling of the sac as the main cause (63 percent); (2) faulty repair of canal; (3) faulty postoperative treatment; and (4) congenital weakness of the transversalis fascia. He also says that in 50 percent of the cases recurrence could have been avoided by competent surgery.

Ramos and Burton (5) give the following in the order of their importance: (1) Incomplete removal of all peritoneal loculi or sacs; (2) overlooking of diverticula; (3) failure to recognize and evaluate weakness or absence of important structures ordinarily used in reconstruction of the walls; (4) unphysiologic reconstruction of the walls.

Their analysis places the blame of recurrence directly on the surgeon. These writers also state that most hernia patients over 30 have a pantaloon or saddle type of hernia.

Stein and Casten give as reasons for recurrence: (1) Persistence of original structural weakness or defect such as weak internal oblique and transversalis fascia, long mesentery, or obesity (qualified by stating that these complications have been taken care of by the original operation and should not be a factor in recurrence); (2) inadequate procedure or technical errors (under this is listed infection, poor hemostasis, division of nerves, bilateral operations, poor attention to the sac and floor, interference with the blood supply, and other related factors); and (3) postoperative factors such as cough, distention, and too early return to heavy duty.

Again most of the failures are attributed to the surgeon rather than to external causes.

Ramos and Burton state that under no circumstances should the internal oblique muscle be sutured to the inguinal ligament. The writer heartily concurs in this view and is emphatic in the statement that the internal oblique muscle should not be sutured to anything, as such a procedure interferes with its physiologic function of closing the internal ring when strain is placed on the abdominal muscles.

Edwards (6), quoting Olgilvie, reiterates this warning in saying that the integrity of the inguinal region depends on the nor-

mal unhampered action of the musculature and any operative procedure which interferes with the normal working of the musculature diminishes the strength of the abdominal wall and tends to favor rather than prevent recurrence.

Iason believes that the common causal factor in recurrence in indirect hernias is a too low ligation of the sac.

As may be seen, poor handling of the sac is considered the chief cause of recurrence, followed by numerous other factors of a technical or nontechnical nature.

In the series presented, the predominant cause of recurrence was inadequate closure of the internal ring, probably brought about by fear of strangulation of the cord. Many rules have been proposed to govern the size of the internal ring, the most pernicious one being that it should be left the size of a man's small finger. Fifty percent of the cords are not as large as a finger and certainly none of them is as firm. Each ring should be left just large enough to fit snugly around the particular cord. This statement may seem elemental but it needs emphasis and repetition. One or two more sutures at the time of the original operation may prevent a second one.

Inadequate closure of the floor of the inguinal canal is second in the list of common causes of recurrent hernia. A direct recurrence results which in reality is not a recurrence but a persistence of an original defect either in the form of the indirect sac or a congenitally deficient musculature; both elements should have been corrected at the original operation. If there is a direct plateau-type bulge, for adequate repair the sac should be opened and imbricated in order to avoid a balloon-like or expanding action on the repair line.

Following this the transversalis fascia should be identified and sutured, a procedure generally considered the most important step in the repair of hernia. Sometimes this fascia is identified with difficulty, but if found weak or attenuated, it should be imbricated. This forms the foundation of the floor of the inguinal canal and must always be repaired if the operation is to be successful, no matter what procedure subsequently is used.

Improper disposition of the sac as a cause of recurrence has been so emphasized that improvement in this regard is noticeable. It is believed that every indirect sac should have a very high dissection with search for multiple loculi and with especial attention to the direct element which is very often present. After the sac has been highly ligated or sewed, transfixation of the stump under the internal oblique is recommended. This turns the apex of the sutured or ligated triangle upward and also acts as a plug to the opening of the internal ring.

Among the miscellaneous causes for recurrence, one instance of severe postoperative wound infection and one of postoperative ether pneumonia were found. There was in addition one patient who, following a bilateral herniotomy, was out of bed in seven days and on the eleventh day carried a 100-pound sea bag out of the hospital. His recurrence came at that time.

It is believed that proof that the use of absorbable suture material throughout the repair might have accounted for some of the early recurrences is wanting. It is well known, however, that catgut varies in absorbability in different patients and in different sizes of catgut, and even in different batches of the same size made by the same company.

In this series cotton was employed for the suturing of the transversalis fascia to the inguinal ligament and for the adequate closure of the internal ring. It has the advantages of being easily obtainable and inexpensive. It has good tensile strength for its size and is nonirritating. In some instances it was used throughout the entire operation, whereas in others chromic and plain catgut were employed in the more superficial layers in conjunction with the cotton. There have been no infections traceable to this practice. Silk may be used if preferred, and is considered superior to catgut and second only to cotton. It seems much safer to allow these patients early ambulation and duty, when it is known that strong, well-placed, nonabsorbable sutures are holding the tissues together.

Spinal anesthesia has been used exclusively in all hernial operations, usually 150 mg. of procaine hydrochloride dissolved in 3 or 4 cc. of spinal fluid and reinjected through the third or fourth lumbar space. It is the anesthetic of choice from the surgeon's and patient's standpoint, is simple to administer, easily transported, and noninflammable. There have been no complications except an occasional atelectasis or mild headache.

One word of caution may well be introduced here, however. The muscles are so relaxed during spinal anesthesia that the tissues may be pulled together too tightly and may tend to pull apart when the anesthetic wears off. Great care should be exercised to avoid tension on the sutures.

Operations.—Many and varied are the operations designed for the repair of a recurrent hernia. The use of a nail to fix the conjoined tendon and the unopened rectus sheath to the inguinal ligament, as done by Thomas (7), seems unphysiologic and involves the use of a metallic foreign body. Wilmoth's (8) proposal of the use of a solution of tannic acid to stimulate fibrous tissue is mentioned only to condemn the procedure.

Torek (9) uses silver wire in the lowest two sutures holding the conjoined tendon to Poupart's ligament, whereas Babcock (10) employs stainless steel wire throughout for ligatures and sutures.

In two patients the method suggested by Burdick, Gillespie, and Higinbotham (11) of using attached strips of external oblique fascia as reinforcing suture material was found helpful as a reinforcement to a small weak spot in the floor or around the internal ring.

Although doubt exists concerning the survival of heterogenous fascia transplants, Koontz (12) uses preserved ox fascia to repair large postoperative hernias.

Gallie and LeMesurier (13) (14) made the first real contribution to hernia repair since Bassini by employing fascia lata strips as living sutures in repairing and replacing deficient hernia floors.

Wangensteen (15) utilized the iliotibial tract of the fascia lata as a pedicled flap over the inguinal ligament. Ramos and Burton (16) modify this by placing it under the ligament. In either case it is a practical utilization of an autogenous graft with its blood supply intact, and is undoubtedly effective in selected cases. However it is a formidable surgical procedure.

McVay and his followers (17) have done the operation using Cooper's ligament rather than the inguinal ligament as the lateral element of recurrent repair.

All of these men have met with various degrees of success with their own operations. The great majority of surgeons who operate for hernia have had little experience with the more extensive procedures involved in these operations.

The surgical staff of the U. S. Naval Hospital at Long Beach has made a careful study of the various operations and their modifications to determine which are of most value in the repair of recurrent hernias and it is the opinion that most of the patients with this condition can be cured by the less complicated operations. However it is of the greatest importance that each of the following procedures be carefully carried out as part of any type of repair.

1. High ligation of the sac with removal of all its loculi.
2. Adequate closure of the internal ring.
3. Repair of the transversalis fascia.

The ultimate success of the repair rests largely on the careful execution of these three things.

Aside from these the operation is adapted to the particular case, sometimes using the suture popularized by Gallie and LeMesurier or by Burdick. More often the Andrews (18) modification of the Bassini operation was done, in which the aponeurosis

of the external oblique was imbricated under the cord, the medial portion being sutured to the shelving edge of Poupart's ligament and the lateral leaf, also under the cord as a reinforcement, was attached to the medial part. Sometimes the imbrication must be incised across its fibers to help enclose the upper boundary of the internal ring after the modification of Zimmerman (19).

TABLE 2.—*Type of recurrent repair*

Operation	Number
Bassini.....	31
Andrews.....	29
Burdick et al.....	3
None.....	2

In 29 patients the cord was transplanted superficially. In no case was there any atrophy of the testicle or disturbance of the circulation of the cord, which can easily happen. In one patient where the Burdick method was used, there was a superficial infection with nonhemolytic staphylococcus which did not noticeably interfere with healing. It should not be necessary to emphasize the importance of complete hemostasis, minimum trauma to tissues, minimum use of suture material, and careful asepsis and elimination of dead spaces. It is to be expected that the ordinary features of good surgical technic will be observed.

Patients with recurrent hernias are kept in bed from 16 to 21 days and in the hospital 30 days. Recommendations are then made that they have light duty for from 2 to 4 weeks. One man with 7 hernial operations was surveyed to limited duty. It may be wise to carry out this procedure with others who have had several repairs.

All wounds were well healed upon the patient's discharge from the hospital and there were no recurrences during this most important period. It is too soon to expect much from a follow-up study. However, even under these conditions and from this small series, the following conclusions may be drawn.

1. Too many surgeons are repairing hernias who lack training for, or fail to exercise care in, this type of surgery.
2. Most of the recurrences could have been prevented by conscientious, careful, meticulous surgery.
3. In undertaking to operate on a hernia that has recurred, the surgeon should have in his armamentarium every operation and modification that may be needed to provide the best possible anatomic and physiologic repair.
4. The prevention of these recurrences depends mainly upon the high ligation of the sac and transfixion of the stump, and oblit-

eration of all its loculi and diverticuli. Adequate closure of the internal ring and careful suture of the transversalis fascia are additional important details in any type of repair.

5. It should be mandatory that health records show the name of the surgeon, suture material used, and the exact procedure followed during the operation.

6. A national central committee for collecting information and data on recurring operations would be a real benefit to the patient as well as to the surgeon and to surgery in general.

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PROTEINURIA IN YOUNG MEN

Urine examinations performed on 22,000 presumably healthy American men entering the U. S. Maritime Service revealed proteinuria in 420 (1.9 percent). In most instances, representing 1.7 percent of the original group, the proteinuria was intermittent or "orthostatic," with incidence highest at age sixteen. The remaining subjects in the series had either continuous proteinuria due to elicitable cause, or mild unsuspected nephritis, or urologic disease. Review of the cases and of the observations on record indicates that intermittent proteinuria in the age period covered is a harmless, benign condition, provided there are no associated clinical or urinary changes. In the study of disturbances accompanied by proteinuria, the concentration of protein in random specimens of urine is not helpful as a diagnostic guide. In random urinalysis of single specimens, nephritis will usually reveal itself. But more cases of urologic or benign intermittent proteinuria will be missed than caught.—WOLMAN, I. J.: Incidence, causes and intermittency of proteinuria in young men. *Am. J. M. Sc.* 210: 86-100, July 1945.



DIRECT EFFECTS OF SUNLIGHT

Direct action of sunlight on the human body must be limited to superficial organs, the skin and the eye. The direct effects themselves are of two kinds, (a) specific effects initiated by a photochemical reaction, and (b) nonspecific or "radiant heat" effects, which merely result from a local rise in temperature. The former result from the activation of molecules by the capture of quanta of radiation. The type of chemical reaction which follows this primary act is determined by the kind of molecules present in the environing system as well as by the activated molecule itself. The effect is characterized by a specific action spectrum, that is, it is produced only by certain wave lengths that are specifically absorbed by the light absorber, the compound whose molecules are activated as the primary event in the underlying photochemical reaction. "Radiant heat" effects also result from the capture of quanta of radiant energy by molecules, but the energy of the absorbed quanta is distributed among the molecules of the system in such a way as to increase the average kinetic energy and hence the temperature of the system.—BLUM, H. F.: Physiological effects of sunlight on man. *Physiol. Rev.* 25: 483-530, July 1945.

INTRABRONCHIAL INSTILLATION OF PENICILLIN OR SULFONAMIDE SOLUTIONS, WITH BRONCHIAL LAVAGE, IN TREATMENT OF SEVERE BRONCHIECTASIS

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For many years various antiseptics or oils have been instilled or vaporized intrabronchially in treatment of chronic pulmonary suppuration. Among these are lipiodol, gomenol, iodine-monochlorophenol, metaphen, mercresin, and ceepryn. Bronchial lavage with saline solution has been advocated to cleanse bronchiectatic sacs of accumulated secretion. With the advent of the sulfonamide drugs, however, the successful use of sodium sulfathiazole by spray or drop in combating certain nasal or paranasal sinus infections led Stacey¹ and others to try the effect of inhalation of these solutions in nebulized form in certain cases of bronchiectasis. The results were gratifying.

Stitt² and Latraverse³ suggested direct instillation of from 2 to 20 cc. of 5-percent sodium sulfathiazole solution into the bronchi by laryngeal syringe or catheter, the direction flow being regulated by posture. Kay and Meade⁴ have recently reported the use of intrabronchial penicillin in lung abscess and bronchiectasis with gratifying results. Romansky et al.⁵ have also introduced into use a combination of penicillin in iodized oil for intrabronchial instillation. The following case of severe bronchiectasis therefore, is reported, in which both sodium sulfathiazole and penicillin were used intrabronchially in generous quantities along with bronchial lavage. Excellent results were obtained.

Case report.—A 17-year-old hospital apprentice was admitted to the hospital on 24 November 1943, complaining of fever, malaise, and cough, of several days' duration, terminating in a chill. Because no positive findings save mild

¹ STACEY, J. W.: Inhalation of nebulized solutions of sulfonamides in treatment of bronchiectasis. *Dis. of Chest* 9: 302-306, July-August 1943.

² STITT, H. L.: Bronchial lavage in nontuberculous infections. *Ann. Otol., Rhin. & Laryng.* 52: 477-485, June 1943.

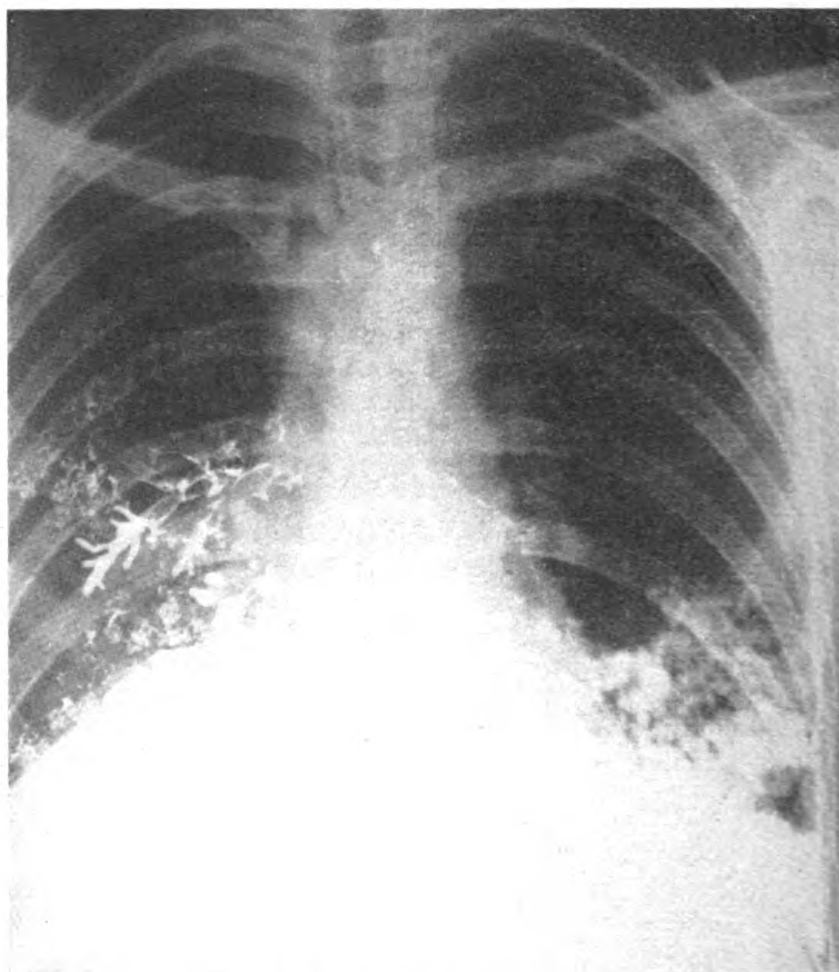
³ LATRAVERSE, V.: Bronchopulmonary suppurations treated with instilled sulfathiazole solution. *Canad. M.A.J.*, 49: 290-293, October 1943.

⁴ KAY, E. B., and MEADE, R. H.: Penicillin in treatment of chronic infections of lungs and bronchi. *J.A.M.A.* 129: 200-204, September 15, 1945.

⁵ ROMANSKY, M. J.; DUGAN, D. J.; and RITTMAN, G. E.: Penicillin in iodized oil for instillation into lungs. *Science* 102: 255-256, September 7, 1945.

pharyngitis and fever of 101° F. were noted, he was put to bed and treated symptomatically for catarrhal fever.

Urinalysis, blood count, and Kahn test were negative. Three days later rhonchi were heard over the right lower lobe and a roentgenogram of the chest revealed a pneumonitis at the right lung base. Under symptomatic treatment the



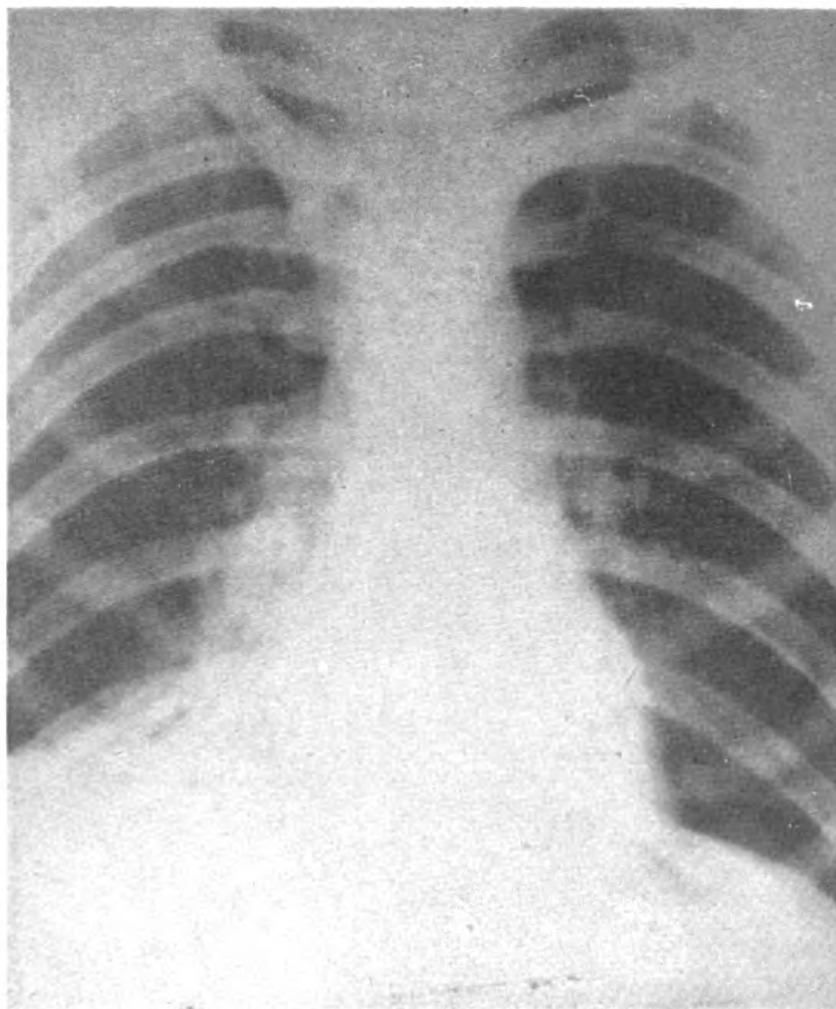
1. Basal pneumonia is present on right, extending along lower bronchovascular trunk to include lower portion of lobe.

patient became afebrile in 10 days, but was kept in bed because of persistent fluoroscopic findings.

On 20 December he developed a fever of 104° F. and there was x-ray evidence of further extension of a right basal pneumonia. His leukocyte count was 29,000. Sulfathiazole, 1 gm. every 4 hours, was given for 5 days, with only moderate effect on either the chest findings or fever; the patient continued to run a low-grade fever and coughed up considerable mucopurulent sputum.

Over the ensuing 2 months the sputum gradually increased, mostly in the morning or with change in position, and despite rest, high calorie and vitamin intake his appetite and weight decreased, while his sedimentation rate and leukocyte count continued elevated.

Bronchoscopy was done on 2 March 1944 with a lipiodol instillation, con-



2. Extensive saccular bronchiectasis on right, as shown by lipiodol. The majority of lipiodol-filled cavities at the base are only barely discernible behind the diaphragmatic shadow. (Alveolar distribution of lipiodol in left lower lobe residual from previous bronchogram.)

firming the clinical impression of an extensive bronchiectasis of the right lower lobe of the lung.

Culture from the bronchus revealed *Streptococcus pyogenes* and the patient was put on a regimen of postural drainage twice daily with bronchoscopic aspiration at intervals of from 1 to 2 weeks.

For the next 2 months the daily sputum amounted to around 300 cc. of purulent fluid, while the patient continued to display pallor, cough, low-grade fever, and weight loss and early clubbing of the fingers appeared. Culture from the right bronchus on 5 May 1944 revealed growth of nonhemolytic streptococci, staphylococci, *Hemophilus influenzae*, and a gram-positive bacillus. Due to the obvious inadequacy of the treatment and the poor condition of the patient, it was decided to try intrabronchial instillation of penicillin at bronchoscopy.

On 24 May, 50,000 units of penicillin solution were instilled into the right lower bronchus after aspiration, and intramuscular penicillin was given in

the amount of 120,000 units daily. After 4 weeks of daily injection, with three further bronchoscopic instillations of 50,000 units, the amount of sputum decreased to half but the general condition of the patient was little improved.

Bronchial culture at the time showed only *Hemophilus influenzae* and *Staphylococcus aureus*, and oral sulfadiazine was prescribed; this therapy, however, had to be discontinued after 5 days because of a leukopenia, the leukocyte count being 4,600.



3. Self-administration of bronchial lavage.



4. Postural drainage.

In the hope of obtaining better results from more frequent application of solutions to the diseased tissue, daily catheter irrigation of the right lower bronchial tree and its sacs was instituted on 26 June; after topical 2-percent nupercaine hydrochloride anesthesia, a No. 14 catheter was passed into the right lower bronchus under fluoroscopic view. A cough reflex was elicited only after 110 cc. of warmed normal saline solution was instilled by gravity.

This procedure was repeated on the following day. At bronchoscopy on the third day the bronchus was observed to be much clearer of secretion. The patient soon learned to perform lavage of his right lower bronchus with no anesthesia, by holding the tongue forward with one hand, and the tip of the catheter in place on the back of his tongue. The saline solution was allowed to collect in the valliculae and overflow through the glottis, being directed thereafter by leaning to the right and forward.

After preliminary postural drainage, the bronchial cavities regularly held from 100 to 120 cc. of saline solution. It was then decided to follow the daily lavage with instillation of alternate quantities of penicillin and of 2½-percent

sodium sulfathiazole, since the mixed bronchial flora had not yielded to the lavage and weekly bronchoscopic instillation alone. From 10 July to 25 July the patient received alternate supraglottic instillation of either 100,000 units of penicillin (in 24 cc. of water), or 30 cc. of 2½-percent sodium sulfathiazole solution, each being given in 2-day courses.

At the end of this 2-week period the daily total sputum had decreased to an amount barely enough to cover the bottom of a sputum cup, the patient had become consistently afebrile, had gained 5 pounds, and noted much less fatigue and weakness even though up and active. Lipiodol bronchograms were again made at this time, revealing the same extensive bronchiectasis already noted. Culture from the bronchus the same day was reported as showing a growth of anaerobic streptococcus, *Hemophilus influenzae*, and *Micrococcus catarrhalis*.

At this time the patient was discharged from the service and transferred to a Veterans' facility. Since the patient did not desire lobectomy he was advised to continue with the daily saline lavage after leaving this hospital: the medical staff of the Veterans' facility at Cheyenne, Wyoming, was kind enough to cooperate in allowing him to keep this up after admission there. In a letter of 20 December, 6 months after the start of intrabronchial lavage and medication, the patient stated that he had gained 43 pounds, had no cough or sputum, he felt well and was normally active without lavage or treatment of any kind for weeks.

COMMENT

The ultimate prognosis for this patient will depend, obviously, on his bronchial response to future acute respiratory infection, which may likely cause recurrence of bronchiectatic suppuration. In such an event the resumption of intrabronchial medication might prove to be of value in the quick control of the process.

Although no measure is comparable to lobectomy in complete removal of bronchial foci of suppuration when accessible, the implications of this case are nonetheless significant. While qualitative control of organisms was not impressive, save for eradication of staphylococci, the quantitative results of lavage and direct instillation were good. The remarkable symptomatic and general improvement speaks for itself.

From the foregoing experience it may be concluded that this mode of treatment may be of value in those patients too septic or acutely ill for surgery, those refusing surgery or those in whom it is contraindicated by reason of complicating illness, or those with extensive bilateral bronchiectasis. The possible value of such measures in cleaning up suppurative bronchial cavities preparatory to lobectomy is not to be ignored, with its reduction of chance of pleural sepsis after operation.

While this patient was exceptionally well adapted to the technic of bronchial lavage and instillation without anesthetic, it is thought with patience and instruction most patients would be capable of mastering it, after a few early sessions with topical

anesthesia. In those unable to do this, frequent instillations of penicillin or sulfonamide solution under direct vision laryngoscopically could be employed.

SUMMARY

A case of severe unilobar bronchiectasis is presented, in which excellent results were obtained by daily bronchial lavage and intrabronchial instillation of penicillin or sulfonamide solutions, after more conventional methods of treatment had failed. The use of this method is suggested for those cases in which surgery is not advisable or desired.



ALLERGY AS FACTOR IN SURFACE ULCERS

Allergenic foods and other substances may produce inflammation and other reactions in the endothelium of the blood vessels, in the same way that they produce the more familiar sensitizations of the epithelium. Six cases are cited: (1) Two patients had pruritus and eczema; (2) three had varicose ulcers of the leg, one of the neck; (3) two had angina pectoris, showing involvement of the coronary arteries; (4) there were two cases of thrombosis of the femoral vessels. In each of the cases described, complete relief of symptoms was obtained by adherence to diets based on avoidance of allergenic foods, as demonstrated by cutaneous tests. In three cases lapses from the prescribed diet brought on recurrence of symptoms.—TURNBULL, J. A.: Allergy as factor in surface ulcers, varicose veins, phlebitis and thrombosis. *Am. J. Digest. Dis.* 12: 272-276, August 1945.



INFARCTION AND CORONARY THROMBOSIS

Evidence is again presented that infarcts which are antero-septal in location, as shown by diagnostic changes in leads from the right precordial area, often fail to produce equally significant changes in the limb leads. In cases of coronary arterial disease some of the attacks of pain which have usually been considered prodromal symptoms of myocardial infarction, actually represent the development of a small, antero-septal infarct, and the more characteristic symptoms of acute coronary thrombosis which often occur later are due to an extension of this initial lesion. The true situation must be recognized if such patients are to be treated properly.—ROSENBAUM, F. F.; WILSON, F. N.; and JOHNSTON, F. D. Changes in precordial electrocardiogram produced by extension of antero-septal myocardial infarction. *Am. Heart J.* 30: 11-18, July 1945.

ANAPHYLACTOID (SANARELLI-SHWARTZMAN) REACTION FOLLOWING THERAPEUTIC ANTITYPHOID INJECTIONS

WITH REPORT OF FATAL CASE

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The employment of various proteins containing products for nonspecific fever therapy is a well established procedure. Antityphoid vaccine preparations are preferred by most physicians to milk, tuberculin, and various commercial products. A recent review by Cecil (1) describes the indications and contraindications for this form of therapy.

Deleterious effects are infrequently encountered, but do occur. In the majority of these untoward reactions there is hyperpyrexia, but a satisfactory explanation of why these unusual catastrophic results occur has not been made.

Peacher and Robertson (2) recently reported two patients with neurologic complications resulting from nonspecific therapy in which antityphoid vaccine was used. In addition they have recorded previously reported complications due to the vaccine injected subcutaneously for prophylactic immunization and intravenously for nonspecific therapy. Such complications include Landry's paralysis reported by Léry and Boivin (3), Guillain (4), and Gayle and Bowen (5); polyneuritis by Jumentié (6), Kennedy (7), Gubb (8) and Robinson (9); central nervous system complications by Preti (2 cases) (10), Noica (3 cases) (11), Roussy (12), Alajouanine, Fribourg-Blanc, and Gauthier (13), Benon, (14), Bury (15), Putnam (16), and Souques (5 cases) (17). Of the above mentioned reports those of Guillain, and of Gayle and Bowen resulted in death. Hench (18) had 3 deaths after 10,000 intravenous injections.

Among the possibilities advanced to explain these deaths are, (1) disturbances of the neurovascular system (acute vasomotor collapse) (Cecil), and hyperpyrexia; (2) vascular changes (disturbances of capillary permeability), and chemical changes lead-

ing to acute thrombosis; (3) stimulation of inflammatory foci of infectious origin (Hench), and anaphylactic shock of the dog type (Ziskind and Schattenberg (20)), and (5) the general Sanarelli-Shwartzman phenomenon (Urbach et al. (21)).

Well known to immunologists is the phenomenon described by Shwartzman. This is a local hemorrhagic necrosis produced in experimental animals by the injection of a bacterial filtrate into the skin (preparatory dose), followed within 24 hours by an intravenous injection of the same or another filtrate (reacting dose). If the reacting or intravenous dose is delayed for 48 hours, this reaction will not occur because the sensitivity produced by the preparatory or skin dose does not last that long. Sanarelli has been able to produce this reaction on a generalized scale by the use of two intravenous injections exhibited within 24 hours. In the experimental animal the postmortem findings produced by the Sanarelli-Shwartzman experiment include petechial hemorrhages in the parenchymatous organs, necrosis of the tubules and glomeruli of the kidney, and focal necrosis of the spleen, liver, and heart muscles.

Lewis (19) reports a fatal case in which antityphoid vaccine was given intravenously for treatment of iritis. The ensuing reaction and clinical course were similar to the one to be described here. This undesired result followed a second injection within a 24-hour interval. Unfortunately permission for autopsy was not obtained.

Urbach, Goldburgh, and Gottlieb reported a death following intravenous injection of antityphoid vaccine. In this case they injected 10 million organisms intramuscularly and 30 minutes later gave 75 million organisms intravenously. The first day there was no febrile reaction, but following the same dosage on the second day, the patient's temperature rose to 106° Fahrenheit. On the third day the same procedure was employed, and a chill and a fever of 99.6° F. occurred, followed by collapse and shock with death 6½ hours after the inoculation. The outstanding postmortem findings were purpura, generalized petechiae in the serous membranes and the parenchymatous organs, acute hepatic necrosis, and acute tubular nephrosis of the liver.

In Ziskind and Schattenberg's case, intravenous antityphoid vaccine was administered for arthritis. The second inoculation was given after a 5-day interval, and 30 minutes after this inoculation the patient collapsed and expired. They explained this fatality upon the basis of an anaphylactic reaction of the dog type. The outstanding postmortem findings were emphysema of the lungs, petechial hemorrhages of the pleura, and congestion of

the vessels of the gastro-intestinal tract and brain. Microscopically the vessels of the liver and kidney were markedly congested, and there were degenerative changes of the hepatic cells but no tubular changes in the kidneys.

Greenfield (22) recently witnessed a death which followed a reaction to the third consecutive daily injection of antityphoid vaccine administered for nonspecific therapeutic effect. This patient had hyperpyrexia followed by a state of oligemic shock from which apparent recovery occurred, but death followed a week after the last injection.

Case report.—A 20-year-old aviation machinist's mate, second class, was admitted to the dispensary on 20 March 1945, with the diagnosis of choroiditis of the left eye. The patient had first noticed blurring vision of the left eye in November 1944, which cleared almost completely in about a month. He had been studied previously at this dispensary, at which time the left fundus revealed vitreous floaters, and a short scarred area parallel with the ora serrata at about 8 o'clock, with adjacent pearly white floaters. There was also a bluish circular lesion at about 7 o'clock near the disk. The patient was sent for consultation to the Naval Hospital, Bethesda, and the ophthalmologic diagnosis was choroiditis. The circular lesion at 8 o'clock was reported as a pigmented area, evidence of an old lesion. The patient's past medical and family histories were irrelevant. Physical examination did not reveal any pertinent abnormality except for the eye condition.

Dental examination did not disclose any focus of infection. X-ray examination of the paranasal sinuses showed the frontals, ethmoid, and sphenoid sinuses to be normal, but there was slight cloudiness of the maxillary sinuses with evidence of a slightly thickened membrane. The Kahn blood test and a urinalysis yielded negative results.

On 3 April all preliminary studies were completed. The patient was given 0.1 cc. (100 million organisms) of anti-triple typhoid vaccine intravenously. The temperature slowly rose to 102° F. in 12 hours and dropped to normal 3 hours later. The patient was comfortable on the following morning, and at 1330 the dose of 0.1 cc. of the vaccine was repeated.

At 1430 the temperature was 102.6° F. and the patient was having a severe chill. The pulse rate rose to 150 per minute and the patient became delirious and comatose at 1500. The temperature was 107.2° F. (axillary), the pulse rate 160, and respirations 23 per minute. He was given an alcohol sponge bath, and at 1530 the temperature had dropped to 104.8° F., the pulse rate to 128, and the respirations to 26 per minute. The temperature remained around 104° F. the rest of the afternoon, and the pulse ranged from 100 to 130 beats per minute and was quite thready.

Early on the morning of 5 April the temperature had fallen to 101.8° F., but the respirations remained around 48 per minute. At 0800, the patient had a slight nosebleed, but this condition seemed much better. The temperature was 101° F., the pulse rate 110, and the respirations had dropped to 35 per minute. At 1000 an infusion of 1,000 cc. of dextrose and saline was given and preparations were made for a blood transfusion. At 1230 it was noted that the blood pressure was 56/24, and the pulse rate 124 beats per minute. The patient was placed in an oxygen tent, and at 1500, 1,000 cc. of whole citrated blood was administered. The patient's condition immediately

improved; the blood pressure rose to 110/60 and the quality of the pulse improved, although its rate remained around 120 beats per minute. Respirations dropped to 20 per minute.

At 2300 a catheterized specimen of 90 cc. of dark brown urine was obtained. Urinalysis revealed a pH of 5, specific gravity of 1.020, albumin 150 milligrams percent, and numerous erythrocytes. At 2200 the patient's temperature was 98.6° F. and his general condition was greatly improved.

At 0200 on 6 April, the patient complained of nausea and started hiccoughing, and at 0245 he vomited about 200 cc. of dark brown fluid, which appeared to be old blood. At that time he appeared to be fully oriented and his condition still seemed to be satisfactory. Intravenous fluids were being continued slowly, so that 3,000 cc. was given in a 24-hour period. At 0800 he appeared well oriented, and his condition was so satisfactory that he was taken off the critical list at 0900. At that time the blood pressure was 118/48, pulse rate 126, and respirations 20 per minute. Shortly thereafter he began to show mental confusion and disorientation and he had repeated attacks of hiccoughing. At 1200 he had another attack of vomiting, and this continued throughout the afternoon.

A blood urea nitrogen test taken at this time revealed 66 mg. of urea nitrogen per 100 cc. of blood. Complete blood count showed a hemoglobin concentration of 75 per cent; the erythrocytes numbered 4,000,000 and the leukocytes 13,600 per cu. mm. of blood. The patient was catheterized again, and 90 cc. of dark brown urine was obtained. Late that afternoon the patient became more confused, restless, belligerent, and disoriented. He was taking fluids by mouth and these were being retained. His pulse rose to 140, respirations were 36 per minute, and the blood pressure was 80/42. During the night the patient was very restless, his condition grew steadily worse, and he died rather suddenly at 0428 on 7 April.

Autopsy findings.—Gross postmortem examination showed that the skin was moderately icteric. In the right pleural cavity there was approximately 150 cc. and in the left, 30 cc. of amber-colored fluid. The upper lobe of the left lung was adherent to the pericardium by firm fibrous adhesions. The right ventricle appeared to be dilated. Beneath the epicardium there was evidence of numerous small areas of ecchymosis. Beneath the endocardium, at the base of the tricuspid valve, numerous ecchymotic areas extended up into the auricle. There were also subintimal infiltrations of blood in the left ventricle.

On sectioning the myocardium, ecchymotic areas appeared to be scattered throughout the muscle substance. The pleura covering the lungs appeared to be edematous and icteric. The lungs appeared congested and dark red in color. The bronchi were partially filled with a thick chocolate-colored material. There were numerous large areas of apparent ecchymosis beneath the peritoneum and in the mesentery. The cut surface of the spleen had the so-called "currant-jelly" appearance. There was a small, firm, white nodule in the center of the organ. The liver weighed 930 gm. and appeared essentially normal except for a light tan mottling.

The gastro-intestinal tract showed only several areas of apparent ecchymosis beneath the gastric mucosa. The left kidney had several apparent ecchymotic areas in the tissue immediately surrounding it. In the pelvis there was a small amount of greenish-yellow pus; there was also subepithelial infiltration of blood. The right kidney was similar in appearance to the left except that there was not so much pus present.

The urinary bladder contained about 15 cc. of a greenish-yellow, turbid

fluid and had areas of apparent hemorrhage and ecchymosis beneath the serosal surface. The testes showed evidence of petechial hemorrhages.

The brain weighed 1,450 gm. and the cerebral vessels were engorged. On sectioning, numerous patches of petechial hemorrhagic infiltration were seen in every area.

Microscopic examination showed the cardiac fibers to be somewhat shrunken in appearance, and there were numerous large apparently dilated blood vessels, some of which showed an extravasation of red blood cells. The lungs showed evidence of acute congestion. All the vessels were apparently engorged and dilated, and red blood cells were found in the alveolar spaces. There appeared to be a moderate amount of edema. The splenic tissue was practically replaced by red blood cells. The liver showed massive necrosis of the hepatic cells. A few degenerating cells persisted about the bile capillaries. There was no regeneration of the capillaries and no fibrosis. The degenerative process was acute and red blood cells were liberated, particularly in the region of the central veins. There was also some fatty infiltration.

The stomach showed a moderate amount of postmortem autolysis. The serosal vessels were engorged as were those of the submucosa. The duodenum also revealed evidence of engorgement and congestion of the submucosa and serosal vessels. The pancreas showed evidence of extensive engorgement. The vessels in the adrenal cortex were definitely congested, as were retroperitoneal lymph nodes.

The kidneys showed a small cortical adenoma composed of cords of embryonic renal epithelium forming minute tubules. The remainder of the kidney was congested. There was a cloudy swelling of the renal epithelium, and also a deposit of albuminous material in Bowman's capsule and in the renal tubules. The urinary bladder appeared essentially normal. The thyroid revealed acute congestion, as did the pituitary gland. The brain showed congestion of all the smaller blood vessels.

Culture of the heart's blood disclosed *Aerobacter aerogenes*. The primary pathologic diagnosis was massive necrosis of the liver; secondary was acute toxic nephrosis, and cortical adenoma, benign; acute congestion of the lungs; an ischemic infarct of the heart; acute congestion of the spleen; congestion of the gastro-intestinal tract; atherosclerosis of the aorta; acute congestion of the brain, and petechial hemorrhages of parenchymatous organs.

The cause of death was considered to be protein shock with hepatorenal syndrome and hyperpyrexia.

COMMENT

Shwartzman described a local hemorrhagic necrosis which could be produced in experimental animals by the following procedure. A local skin site is infiltrated with a bacteria-free filtrate such as typhoid bacillus culture. Twenty-four hours later this same material or other bacterial-free culture is injected intravenously. The sensitivity produced by the local preparatory injection lasts only 24 hours and the provocative intravenous injection must be given within that time.

Sanarelli produced this same phenomenon on a generalized scale by giving both preparatory and provocative injections intravenously. Thus Urbach et al. state that this reaction should be

called the Sanarelli-Shwartzman phenomenon. Such reactions properly belong to the hypersensitivity group and are either anaphylactic reactions or closely allied. As the question of the occurrence of true anaphylaxis in the human is doubted by many allergists and immunologists, the authors prefer to straddle this issue with the compromise term "anaphylactoid."

While Sanarelli and Shwartzman used bacteria-free cultures to produce the reactions in experimental animals, dead bacteria are utilized in intravenous injections in nonspecific therapy in the human. There can be little doubt that not only is there a release of toxic end-products in the vaccine solutions as a result of mechanical shaking before injection, but such products are freed from the bacterial cell within the body to bring about the desired febrile reactions.

The important practical clinical aspect is that this type of reaction can be avoided if an interval of 48 hours intervenes between injections. This has been the customary clinical practice based on empiric grounds and accounts for the fact that these reactions have been reported so infrequently. Furthermore such deaths are not always reported in the literature, and certainly the Sanarelli-Shwartzman reaction is not well known to practitioners.

The patient whose case is reported here had all the findings described by Urbach and his coauthors excepting purpura. This feature was also lacking in Lewis's case, which clinically seems best explained upon this basis. Unfortunately, Lewis was unable to obtain postmortem studies.

Urbach and his coauthors state that the death reported by Ziskind and Schattenberg is explained upon this same basis. However this reaction occurred after an interval of 5 days between injections, and the postmortem findings were not similar to those in their case. Petechial hemorrhages were found in the pleura only, and there was no necrosis of the liver or kidney tubules.

CONCLUSIONS

1. A fatal reaction following a second intravenous injection of antityphoid vaccine given within a 24-hour interval for nonspecific therapy is reported.

2. The autopsy findings of generalized petechiae throughout the parenchymal organs and brain, and massive necrosis of the liver and kidneys, indicate this to be a generalized anaphylactoid reaction similar to that obtained by Sanarelli and Shwartzman in experimental animals.

3. This reaction can be avoided by allowing an interval of at least 48 hours between injections.

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ROENTGEN DIAGNOSIS OF DEFORMITIES OF THE CARDIAC END OF THE STOMACH

INTRINSIC AND EXTRINSIC IN ORIGIN

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The nature of intrinsic as well as extrinsic masses at the cardiac end of the stomach is sometimes difficult to determine. Even the simple recognition may present difficulties, especially of the early small intrinsic nonobstructive polypoidal new growths. Because of the absence of any dysphagia, these are seldom diagnosed or even suspected clinically.

This paper is therefore directed toward a consideration of all such masses and their differentiation, with particular emphasis on the two objectives of establishing the deformities of the cardia which are of intrinsic origin, and those which are extrinsic (non-gastric) in origin, especially those which have no clinical significance.

Anatomy.—The size, shape and position of the stomach present variations, not only among different persons, depending on their habits, but also in the same person at different times. The tone, the degree to which the stomach is filled, the position and size of the adjacent organs, the condition of the abdominal walls, the respiratory phase, and even posture can influence its shape and relations.

Of recent years, examination of the stomach roentgenographically has afforded information otherwise unattainable, particularly regarding the shape and position of the stomach in life, the changes it undergoes, and the numerous slight anatomic variations in the position of the surrounding organs.

The cardia is related superiorly to the left part of the diaphragm and the apex of the heart, medially to the left border of the liver and its associated ligaments, and laterally to the splenic flexure and the spleen, both of which may extend higher than they normally do and separate the cardia from the left diaphragm.



1. Mass in the upper posterior wall of the cardia demonstrated by the double contrast method.

The rugal folds in the fundus conform to fairly standard patterns, differing with the character of the person. In the hyposthenic type they are usually parallel vertically, whereas in the sthenic or hypersthenic type they are either curvilinear or concentrically arranged in whorls.

Roentgen examination.—This consists of three parts; preparation, adequate history, and roentgen study. As for the prepara-

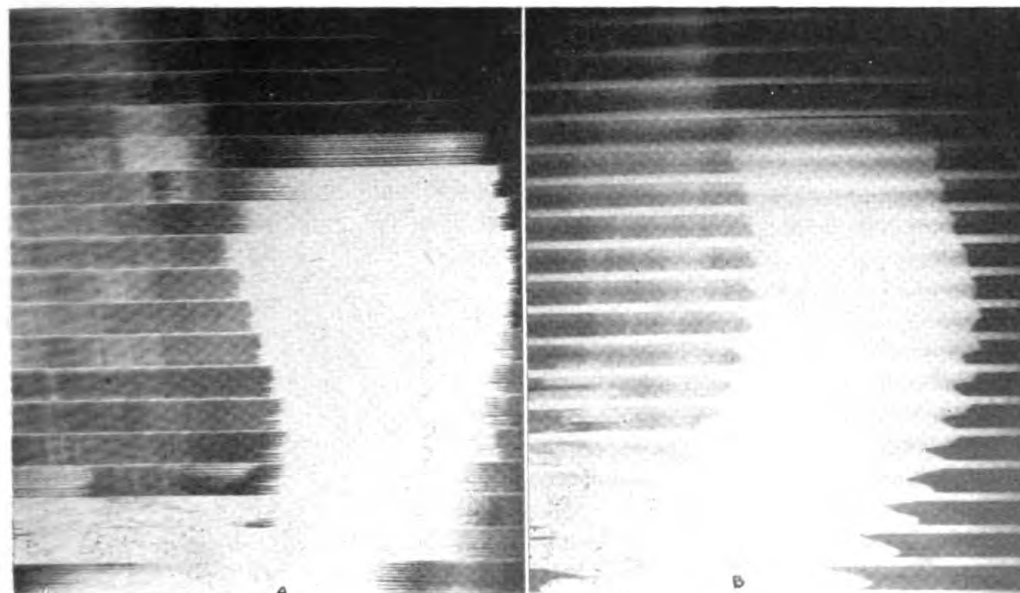
tion, the patient presents himself after fasting 12 hours and without having taken any solid medication such as Sippy tablets or powders. The request card should contain an adequate history stating the age, sex, occupation, clinical diagnosis, previous operations, physical findings, laboratory data, and important complaints with their duration.

Roentgen study, the third phase of the examination, includes the following methods:

1. Simple fluoroscopy or film in the upright posture for inspection of the *magenblase*, which may show a deformity if there is sufficient gas in the cardia.

2. Administration of a simple barium mixture with fluoroscopy and films. First the rugae are studied after a teaspoonful of a special rugal mixture is administered. This is followed by the full drink of 8 ounces of barium mixture. Fluoroscopy of the stomach, including the chest, diaphragm, esophagus, with coughing and straining, is made in all positions—upright, horizontal and Trendelenburg, in the A-P, P-A, left and right oblique and lateral. Care must be exercised to administer the barium slowly and to avoid overfilling, especially in the supine and Trendelenburg postures.

3. Formation of gas. This is accomplished by the use of effervescent powders or stomach tube (powders are now used exclusively).



2. (A) Kymogram of a normal stomach. Note pulsation recordings along the upper ends of the lesser and greater curvatures. (B) Kymogram of the case of the carcinoma involving the upper inner angle of the cardia. Note the absence of pulsation recordings in the involved areas.

4. Double contrast. This is the use of gas and barium combined.

5. Modified opaque method. This is the administration of one mixture which simultaneously visualizes the full stomach and the rugae.

6. Kymography. This may be of use in two ways: (a) Study of peristalsis, which is not very active in the cardia—therefore, of little use; (b) recording of transmitted arterial and cardiac pulsations which are seen normally. These may be absent if the area is infiltrated and frozen.

7. Pneumoperitoneum. This is of use in differentiation between extrinsic and intrinsic lesions.

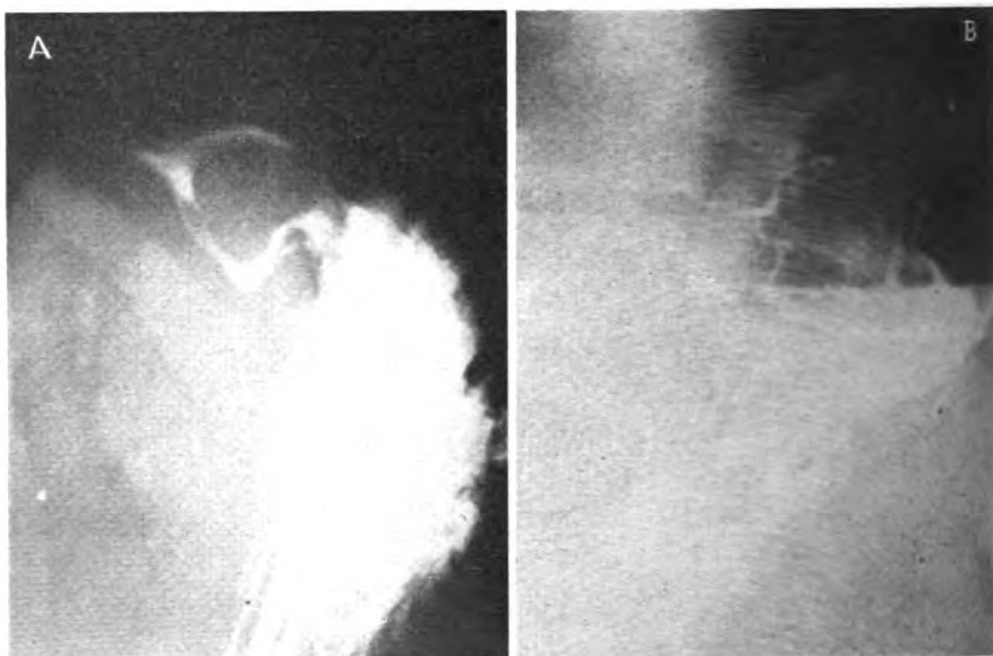
8. Recording. Fluoroscopic and roentgen findings must be adequately recorded. The following are recorded:

(a) Habitus: Esophagus—position, patency, contour, peristalsis; stomach—tonus, type, size, mobility, flexibility, peristalsis, rugae, contour, spasm.

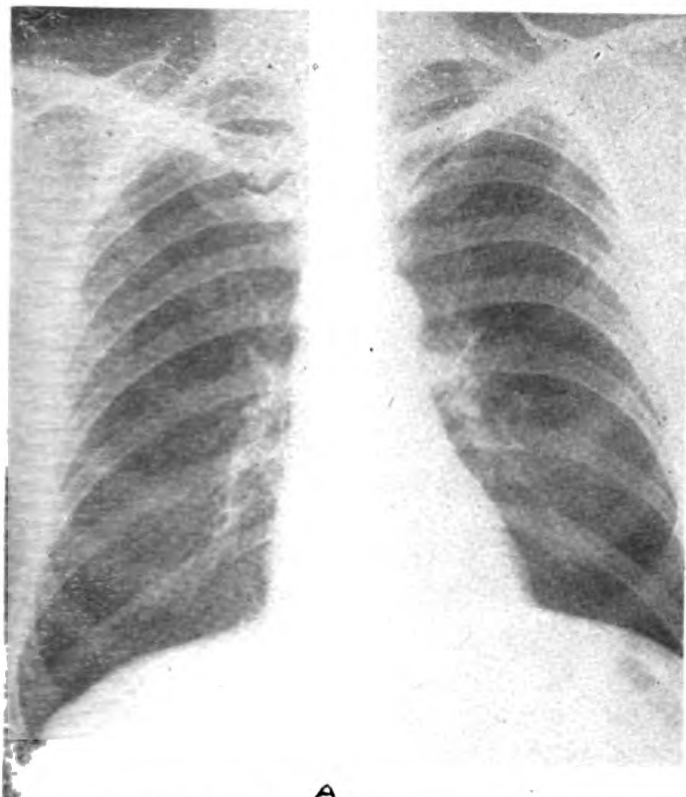
(b) Sensitive point: The overlying costal structures prevent the eliciting of a sensitive pressure point in the cardia, or the palpation of a mass, or the compression of the rugae. Therefore no statement regarding these can be made.

Diagnosis of intrinsic masses.—Intrinsic lesions are characterized by their constancy and position. They are:

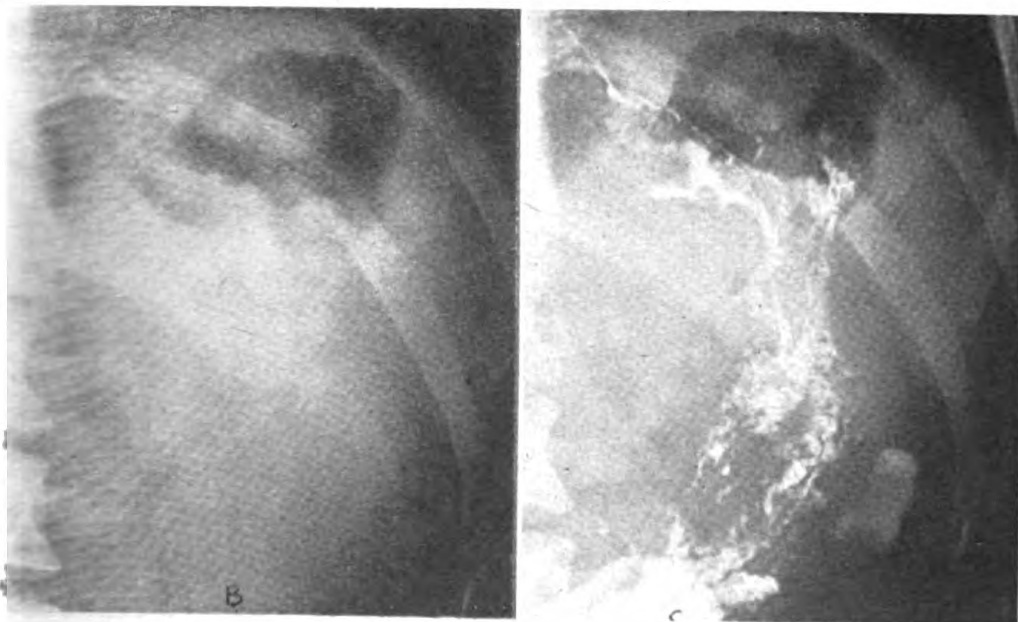
1. New growths. (a) Malignant—mesial aspect is a favorite



3. (A) Benign mass at the esophagogastric junction. The barium is seen forking around the mass. (B) Large carcinoma seen in the gas bubble near the entrance of the esophagus.



4. (A) Large mass causing deformity of the upper inner angle of the cardia resulting from lymphoblastoma. (B) Same patient showing mass outlined in the cardia without contrast material. (C) Same patient showing the mass in the cardia and multiple other masses distributed throughout the stomach after administration of a small amount of barium.



site. (b) Benign—very rare.

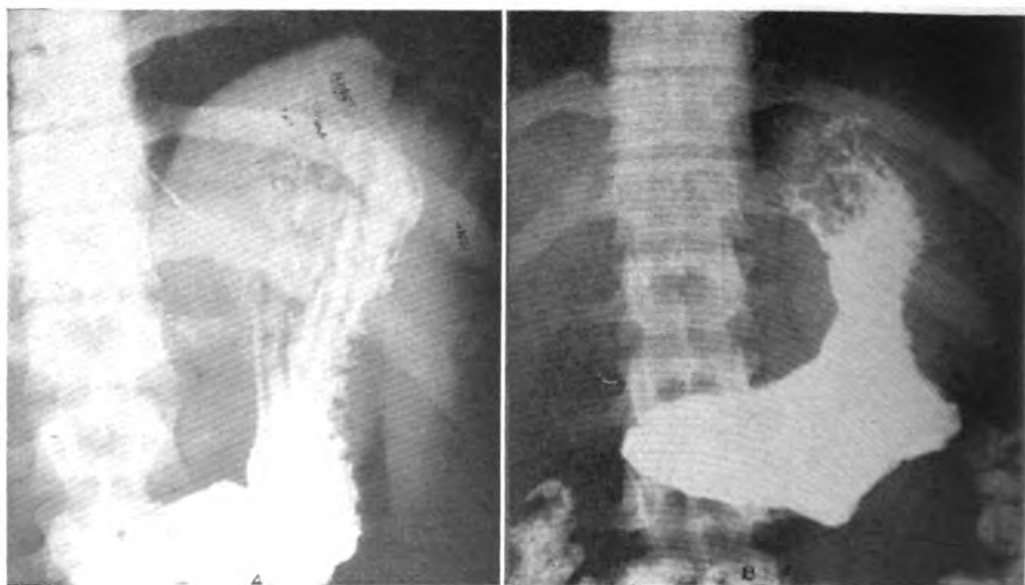
2. Polypoid, hypertrophic gastritis.
3. Posterior wall diverticulum.

Normally, the cardia of the stomach is regular in outline and transradiant.

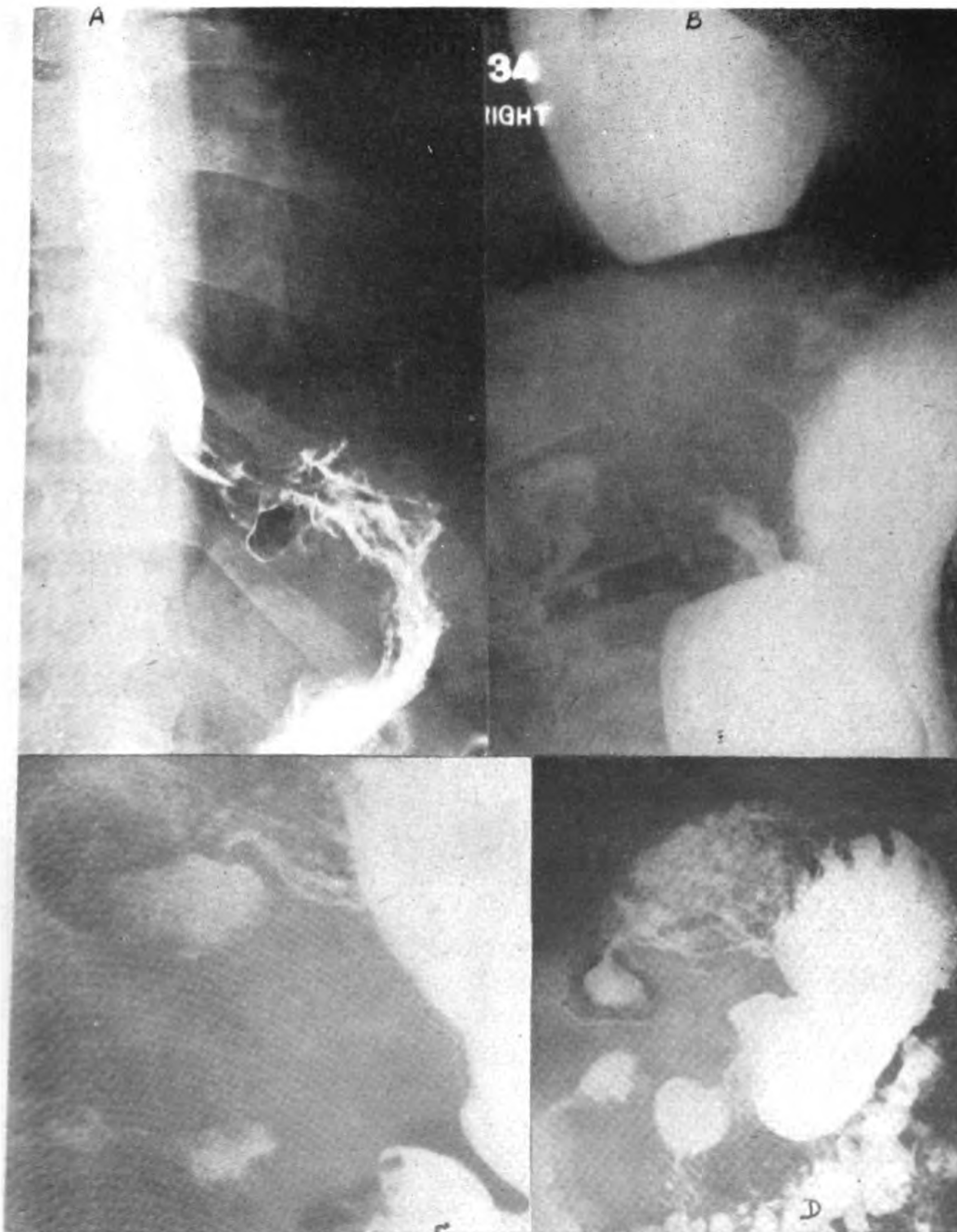
Criteria for intrinsic malignant new growth are: (a) Shad-

ow of tumor within gas bubble; (b) deformity of the contour of the dome with a filling defect; (c) distortion of the terminal esophagus, with or without dilatation above; (d) destruction or distortion of the rugae—scirrhous new growth may produce a ground-glass appearing atrophied or granular mucosa; (e) deviation or forking of the stream by the tumor; (f) flow abnormally retarded or continuous; (g) unchanging canalization through the tumor, due to the loss of distensibility; (h) frozen mass which prevents the normal swaying movement and peristalsis of the esophagus; (i) esophageal antiperistalsis; and (j) increased distance between the cardia and the left diaphragm. This, however, may also be due to empty stomach, free abdominal fluid, regional fat, or interposition of the splenic flexure, spleen or the upper tip of the left lobe of the liver and its triangular ligament.

Polypoid or hypertrophic gastritis produces a rather uniform increase in the width and height of the rugae with some irregularity. The rugae otherwise retain their pattern, suppleness and other normal mucosal characteristics. These changes may be limited to the cardia or be part of a generalized gastritis. Congenital giant-sized rugae or lymphoblastomatous infiltration may resemble hypertrophic gastritis, and should always be borne in mind in the differential diagnosis.



5. (A) Defect in the upper inner angle of the cardia due to impingement of the enlarged left lobe of the liver which extends up to and interposes between this portion of the stomach and the left diaphragm. (B) Extrinsic pressure defect on the upper outer angle of the cardia and upon the upper half of the greater curvature of the stomach due to an enlarged spleen.



6. (A) Moderate sized diverticulum in the lower third of the esophagus. (B) Large sized diverticulum in the lower third of the esophagus. (C) Large sized diverticulum arising from the superior posterior aspect of the stomach. (D) Moderate sized diverticulum arising from the superior posterior aspect of the stomach.

Posterior wall diverticulum is easily ascertained by examination in the right oblique view of the barium-filled stomach.

Diagnosis of external masses.—The nature of adventitious shadows producing extrinsic deformities should be studied care-

fully. They usually have a regular margin and the overlying and underlying gastric rugae are intact. Extrinsic masses may show from:

1. Enlargement or variation in the position of the normal surrounding organs.

The apex of the heart may indent the cardia from above, and if so, it will pulsate; will disappear or diminish in size on deep inspiration; and will be differentiated by cardiac kymography.

The splenic flexure can be determined by gas within the colon outlining its structure or, if necessary, by a barium enema.

The spleen may be involved in its upper and medial aspect.

The upper tip of the left lobe of the liver may sometimes indent the cardia, especially when the stomach is collapsed.

2. Para-esophageal herniation of the cardiac end of the stomach with drawing up of the upper inner angle of the cardia alongside the left border of the esophagus, producing a dead space partly filled in by the tip of the liver and its associated triangular ligament and by the regional fat when present. This produces a mass localized on the film to the upper inner angle of the cardia which definitely has no clinical significance. This mass will disappear when the hernia is reduced, usually by just assuming the upright posture.

3. Low esophageal diverticulum on the left wall, which can easily be distinguished with a swallow of barium.

4. Diaphragmatic hernia, which should offer no difficulty.

5. Other extrinsic masses, due to: (a) A mass associated with carcinoma of the lower esophagus; (b) multiple extrinsic masses indenting the cardia on more than one surface, such as in lymphoblastoma; and (c) a mass apparently localized to the cardia produced by a fluid-filled stomach exposed in supine posture. The fluid gravitates to the cardia, which is the most dependent portion in this posture.



ERYTHEMA AND INFLAMMATION

Essentially the same tissue responses occur in sunburn that occur in inflammatory processes in general and it seems not unlikely that the same underlying mechanisms operate in bringing about these responses.—BLUM, H. F.: Physiological effects of sunlight on man. *Physiol. Rev.* 25: 483-530, July 1945.

OCCURRENCE OF PSYCHONEUROTIC SYMPTOMS ON THE VARIOUS SERVICES OF A NAVAL HOSPITAL

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Conditions inherent in service life have acted to uncover or aggravate the neurotic tendencies of an impressive number of men who made a fairly adequate adjustment under the more flexible environment of civilian life. This has resulted not only in a high admission rate to the neuropsychiatric services of Naval medical facilities, but it has also increased the frequency of occurrence of psychoneurotic symptoms on the medical and surgical services. Many cases are seen wherein the organic condition for which the patient was admitted appears relatively of less importance than his personality defect. The present study was undertaken in order to estimate the rate of occurrence of personality disturbances on the medical and surgical services of a large Naval hospital.

Until recently adequate means were lacking by which this problem could be studied. There were insufficient time and trained personnel to make the evaluation by personal interviews. With the introduction of the Cornell Service Index¹ a means was provided of obtaining an estimate of the number of psychiatric complaints by a self-administered questionnaire specifically designed to apply to men in service. Research on the Cornell Service Index has indicated² that the results obtained by that instrument are valid and are effective in the analysis of groups. It has also been shown that the form does not clearly separate those who are sufficiently nervous to be disposed of with a psychiatric diagnosis from those who, though nervous, are not sufficiently so to warrant disposition on that basis. Hence it must be emphasized that al-

¹ WEIDER, A.; BRODMAN, K.; MITTELMANN, B.; WECHSLER, D.; and WOLFF, H. G.: Cornell Service Index: Method for quickly assaying personality and psychosomatic disturbances in men in the armed forces. War Med. 7: 209-213, April 1945.

² WARNER, N., and GALLICO, M. W.: Use of Cornell Service Index in evaluation of psychiatric problems in a Naval hospital. War Med. 7: 214-217, April 1945.

though the figures given below indicate the frequency and severity of neuroses on the wards studied, they do not indicate how many of the patients with high scores (i.e., indicative of considerable personality disturbance) might be eligible for disposition on a psychiatric basis. Many psychoneurotics are continuing to function effectively in service in spite of their personality disturbances.

METHOD OF PRESENTATION AND FINDINGS

The Cornell Service Index was presented to patients in groups of from 20 to 75 men. Prior to administration the subjects were told that the information obtained was to be used for research purposes and that it would not be incorporated in their hospital records without their specific permission. The patients cooperated very well, on the whole.

Some of the wards included in this study were tested more than once; other wards were so tested as to include only a random sample of the patients assigned to the particular ward. Consequently the figures cannot be interpreted as an indication of the relative occurrence of various diagnoses at this hospital.

The figures obtained are shown in the accompanying table. The columns represent the following subject types:

1. Psychiatric prison ward (as distinguished from the locked ward for psychotic patients).
2. Psychiatric cases not under confinement.
3. A prison ward for other than psychiatric cases.
4. Gastro-intestinal cases.
5. Allergy cases.
6. Malaria and filariasis cases.
7. General surgical and neurosurgical cases.
8. General medical cases.
9. Orthopedic cases.
10. A group of selected hospital corpsmen, in service over a year and performing adequately at duty.
11. Chronic chest cases—medical and surgical (no cardiac cases are included in this group).

No group of cases appears in more than one column. Thus, column 8 (general medical cases) does not include gastro-intestinal or malaria and filariasis cases, recorded in columns 4 and 6 respectively; column 11 (chronic chest cases) does not include cases of asthma, which are recorded in column 5 (allergy cases), etc.

In this compilation the columns are arranged in order of descending median scores. (The median score is the middle, or

Responses of various patient groups, and a normal group, to the Cornell Service Index

	Col. No.	No. of cases	Median scores	Percentage of scores above				
				9	15	30	42	51
Psychiatric prison ward.....	1	61	41	95.1	91.8	72.1	42.6	21.3
An open psychiatric ward.....	2	over 120	29	91.3	85.3	45.8	21.7	9.1
Nonpsychiatric prison ward.....	3	66	26	78.8	68.2	45.4	30.3	24.2
Gastro-intestinal cases.....	4	96	21	71.9	61.5	29.2	13.5	6.3
Allergy cases.....	5	57	16	68.4	56.1	17.5	3.5	1.8
Malaria and filariasis cases.....	6	61	14	63.9	39.3	14.8	0.6	1.6
General surgical and neurosurgical cases.....	7	over 120	11	52.1	31.3	16.6	7.4	3.7
General medical cases.....	8	over 120	11	60.3	41.3	12.4	5.0	0.0
Orthopedic cases.....	9	over 120	8	42.8	31.0	8.3	3.4	1.4
Hospital corpsmen.....	10	67	7	32.8	14.9	4.5	0.0	0.0
Chronic chest cases.....	11	66	5	30.3	15.5	6.1	3.0	0.0

fiftieth percent, score in the distribution curve of the particular group.) In groups composed of less than 120 subjects the exact size of the group is given. The remaining groups are designated as over 120 in size. These groups range from 121 to 286 in size. The total number of cases included in all groups recorded is 1,289.

For each group are given the percentages of the group which obtained scores above 9, 15, 30, 42, and 51. The authors of the Cornell Service Index have found that a score above 13 usually indicated a mild personality disturbance, while a score above 23 usually indicated a severe personality defect. The present authors would be inclined to place these figures at a slightly higher level—for example, at 15 and 30 respectively. Those persons with scores above 42 were almost uniformly severely neurotic.

ANALYSIS OF THE DATA

As shown in the table, the scores for patients on the psychiatric service are higher than for any other group of patients. Psychiatric patients confined to the prison ward for reasons of misbehavior differ, as a group, from the psychiatric patients on the open ward in that the median score of the former group is much higher (41 as against 29). Also a much larger percentage of them have very high scores; 42.6 percent of the disciplinary groups have scores above 42, as against 21.7 percent on the open ward.

The group with the next highest median score (26) is composed of patients who did not have psychiatric diagnoses and who were not admitted to the psychiatric service, but who were confined to a locked ward for reasons of misbehavior. This group shows more of a tendency to a bimodal distribution than the other groups; and its figure of 30.3 percent of cases with scores above 42 compares rather closely with the group of psychiatric prisoner cases.

These figures tend to substantiate our clinical impression gained on interviewing psychiatric patients in a military setting; namely, many of those who get in trouble with the authorities do so as a result of their nervous symptoms. One often hears severe psychoneurotics explain their absence without permission or their other misdemeanors by saying that they were so "keyed up" they no longer cared what they did and gave no thought to the consequences. The bimodal distribution found on the nonpsychiatric prison ward suggests that in such wards one finds two types; they are the man who is too nervous to stay out of trouble, and the man who is not particularly nervous but who may be more properly considered to have committed his offenses in a deliberate manner. It is probable that the disciplinary patient with a low score on the Cornell Service Index will respond more favorably to punishment than will the man with the high score.

A few of the patients with very high scores on the nonpsychiatric prison ward were interviewed after they had completed the questionnaire. The number of cases was small, but those who were so interviewed gave evidence of having answered the form honestly and with reasonable accuracy. The most striking thing about this group was that though they had many nervous complaints, they had never thought of themselves as being particularly nervous, and they had never considered the possibility of being admitted to the sick list as a psychiatric patient. This was not true of the patients on the psychiatric service with high scores, for almost without exception they considered their problems primarily in terms of their nervous state.

The fourth column in the table gives comparable figures for a group of gastro-intestinal cases. This group is composed mainly of men who had at one time or another been suspected of having gastric or duodenal ulcer; and in about three-quarters of the cases no demonstrable organic pathosis had been found after careful study. These men reveal scores surprisingly similar to those of the psychoneurotics on the open ward (column 2). In doing consultations for the psychiatric service it was found that a sizeable percentage of those who complained of gastro-intestinal symptoms of some sort could readily be shown on careful questioning to have marked diffusion of neurotic complaints unrelated to the alimentary canal. This symptom scattering was more in evidence on that service than on any other except the psychiatric service itself.

Figures for a group of patients with established organic pathosis of the stomach are not shown in the study, as the series is too small to permit reliable deductions. However it may be said with

little fear of error that what data is available tends to show that this organic group differs in score very little from the functional group.

The importance of psychologic mechanisms in the production of allergic symptoms has frequently been emphasized; and our figures support this concept, for the group with the next highest median score (16) is the allergy ward (column 5). It is interesting that this group is of higher median score than that of the malaria and filariasis patients, almost all of whom had seen various degrees of combat in the South Pacific and were entitled to be somewhat nervous on that basis.

General surgical and neurosurgical cases are grouped together (column 7) because there is no significant difference in the scores of the two surgical types, and the cases were sufficiently similar from an organic point of view to justify such a combination. The scores for the surgical service are a little higher than those for the medical service (column 8), a difference which might well be accounted for by the somewhat higher percentage of combat casualties on the former service. In any case the difference between the two services is not great.

In view of the lament so frequently heard that one sees innumerable cases of functional backache and painful feet, it is a little surprising that the orthopedic service should have such a low median score (8), and that there are so few scores above 30 and particularly above 42. It should be pointed out that the Cornell Service Index does not usually give a high score to the pure conversional syndrome, without scattering of symptoms. However various authors have commented on the fact that pure conversion hysteria is rarely encountered in the service, and that the great majority of servicemen with conversional symptoms also present many scattered neurotic complaints, usually with strong anxiety features. This has likewise been our experience. It seems safe to say that the above figures for the orthopedic service indicate that the prevalence of neurotic complaints among such patients has often been exaggerated.

By way of giving a group approximating a "normal," the results obtained on 67 corpsmen are included (column 10). As noted above, these corpsmen had all given an adequate account of themselves in over a year of service with the Navy, and the majority of them had been on duty for more than 2 years. The absence of extremely high scores in this group is striking. Four and a half percent of the corpsmen showed scores in the definitely neurotic range, but were managing to carry out their duties adequately despite that.

Finally the most favorable median score is obtained by a group of chronic chest cases. Although 3 percent of this group had scores of over 42, and 6.1 percent over 30, there is a higher percentage of scores below 10 than for any other group. This bears out the common observation that patients with chronic chest disease ordinarily have a cheerful, wholesome, constructive attitude toward their illness.

SUMMARY

By means of a self-administered psychoneurotic inventory a quantitative analysis was made of various types of patients, and of a group of normal hospital corpsmen. The median score of each group of patients is submitted, together with an approximate indication of the distribution of scores within each group. The figures for the various groups are compared.



PENETRATION OF PENICILLIN INTO THE EYE

Penicillin was capable of traversing the human cornea when introduced into the conjunctival sac by continuous irrigation with a solution. The damaged cornea apparently allows considerable penetration but the normal cornea is less permeable. A damaged epithelium (especially if edematous throughout) or a cocaineized epithelium probably behaves as would epithelium treated with a wetting solution. When penicillin was administered intramuscularly, it appeared in the aqueous humor of both primary and secondary types but in very much lower concentration than that attained in the serum. Higher intra-ocular concentrations than those found after intramuscular penicillin were produced in each eye subjected to iontophoresis, but the improvised apparatus employed produced an undesirable complication (corneal nebula). It is at present impossible to define the concentration of penicillin in either blood or tissue fluid necessary for therapeutic effect. It may be that the small amounts of penicillin reaching the aqueous humor after intramuscular penicillin or penicillin baths, will prove to be clinically adequate. The fact that high intra-ocular concentrations can be obtained by the iontophoresis method, is significant and probably worthy of further investigation.—WRIGHT, R. E., and STUART-HARRIS, C. H.: Penetration of penicillin into eye. *Brit. J. Ophth.* 29: 428-436, August 1945.

DISCIPLINARY PROBLEMS AMONG MEN WITH COMBAT FATIGUE

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Men with symptoms of combat fatigue, who are basically non-delinquent, with good previous records, and who commit Naval offenses, usually do so because of their symptoms and because they are emotionally ill. They are usually good seamen, and preventing their commission of offenses would save valuable manpower. The purpose of this article is to point out how the medical officer, by understanding the psychodynamics of their behavior, can better handle and detect such men prior to their opportunities to commit offenses. This, of course, does not mean that, having become involved, such offenders are necessarily to be excused from penalties imposed by the proper authorities.

The symptoms of combat fatigue are the result of pathologic compromise of the conflict between the dominant instinct of self-preservation and the dangers (threats to life) incident to combat service. The symptoms are well known and have been amply discussed elsewhere. They vary from severe emotional storms, mobility storms (trembling, cataleptic states), and autonomic nervous system alterations, to the more commonly seen anxiety states.

Detection of major alterations in the personality is relatively easy. A disciplinary problem exists among the so-called ambulatory combat fatigue patients who do not have major changes in personality, yet whose symptoms are more intense than, or who have certain attributes differing from, the average ambulatory patient. Ambulatory combat fatigue is quite common aboard ship after much action and is not necessarily incapacitating. Irritability, startle reaction, nightmares and tension symptoms are common, but those who become Naval offenders seem to have certain other attributes that are probably predisposing to the commission of infractions.

The men fall into two rather convenient although arbitrary groups. However in both groups contact with the softness and safety of home life and the over-solicitous attitude of the family often augment the basic conflict between self-preservation and exposure to danger. This conflict plays its role in the production of offenses.

The first group includes men who have developed very definite somatic symptoms such as headaches and abdominal pain, and those who have become fearful of "cracking up," men who have marked anxiety symptoms with physiologic concomitants, men who display apathy, indifference, and depression. These men often attempt to alleviate their symptoms and tensions by taking refuge in alcoholic beverages. The quite common lessened tolerance to alcohol usually leads them into committing Naval offenses. Inhibitions, fostered by Naval training, are often cast aside due to the release afforded by liquor and emotional disturbances. The previously controlled impulses to escape from anxiety-producing situations are carried out. Some individuals have such profound anxiety—such a feeling of helplessness and of being threatened—that their judgment is impaired, their behavior impulsive, and they seek only to run away from the overwhelming situation. The most common offense committed is usually "missing ship;" the pretexts and rationalizations for the offense are varied.

The other group consists of men who, while suffering with combat fatigue symptoms, have dominant feelings of hostility and resentment. They are almost paranoid in their expressions of resentment, which are usually directed toward their superiors in rate or rank. These men often become irritant foci and are the precipitants of innumerable brawls usually resulting from trivialities. Frequently before the patient commits a major Naval infraction, he has been noted as a troublesome focus aboard ship and has come to captain's mast. These men develop such feelings of hostility and resentment because they are anxious, unsure of themselves, feel that they have not been protected, and construe any act that threatens their security as an aggression, and react with counteraggression. Punishment merely increases their resentment.

The medical officer can quickly make himself aware of the men whose combat fatigue symptoms, personality changes, and attitudes are such that they become conspicuous in constant brawls following alcoholic bouts or sickbay visits. These men ordinarily should be hospitalized promptly. Although combat fatigue is widely considered to be a self-limiting syndrome, and there are numerous ambulatory patients perfectly capable of performing their duties, others become liabilities to the Navy because of offenses. If possible, a rapid routine screening of men prior to departing on leave after a long, arduous cruise may enable the medical officer to pick out the potentially difficult. Since symptoms are masked considerably prior to a leave, and perhaps exaggerated prior to a sailing, a goodly amount of acumen is necessary.

BACTERIOLOGY OF WAR WOUNDS IN THE PACIFIC AREA

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In a little more than a year, 2,740 fresh battle casualties were treated on board a hospital ship in the Pacific area in the course of 5 island campaigns. The patients were brought to the ship rapidly in small boats and amphibious vehicles and usually the ship was loaded to capacity within 36 hours. Definitive treatment was carried out as quickly as possible and the patients were observed and treated during the long voyage to a hospital far from the scene of battle.

It early occurred to us that the culture of all wounds was highly desirable. This ideal was not possible, however, because such large numbers of casualties were admitted in such short periods of time. The laboratory personnel were some of the busiest in the hospital organization. With the complete cooperation of the medical staff and the laboratory it was possible to culture the wounds of 161 patients. As a rule these wounds were some of the most severe encountered, and were large, extensive, and frequently multiple. The wounds of 86 patients (53.42 percent) were caused by fragments, 54 (33.54 percent) were inflicted by bullets, and in 21 patients (13.04 percent) the type of missile causing the wound was not established.

Wounds which are sustained in civil life are usually seen by the surgeon within a few hours. In war the time elapsing before the wound reaches the surgeon may be considerably greater, depending upon the ferocity of battle and on transportation facilities. Eighty-three (51.6 percent) of the patients whose wounds were cultured were on board the hospital ship and under treatment within 24 hours. Some of these were admitted only a few hours after being wounded, and an additional 30 patients (18.8 percent) were seen during the second 24-hour period.

In many instances tissue was taken from the wound and sent to the laboratory for culture. When tissue was not available or was not used, a swab culture was taken. Blood agar plates and

tryptose broth were inoculated for the culture of aerobes. For determining the presence of anaerobes a dextrose-agar stab heated at 70° C. for 10 minutes, a meat infusion medium, a dextrose-agar stab unheated, and litmus milk were inoculated.

Our previous experience with gas gangrene, our fear of that serious wound complication, and our eagerness to detect anaerobic infections early led us to devote more attention to anaerobic cultures than to aerobic cultures. One hundred sixty wounds were cultured for the presence of anaerobes and the cultures were positive in 77 (48.12 percent).

Clostridium perfringens was the anaerobe most frequently found; it was present in 57 (74 percent) of the 77 wounds from which anaerobes were cultured. Unclassified proteolytic anaerobes were present in 24 cases, and from 23 wounds more than 1 species of anaerobe was obtained by culture. Clinical gas gangrene developed in 27 cases, 35 percent of those which had yielded positive cultures, and in 1 case in which admission culture did not yield anaerobes. During the period of this study other cases of gas gangrene were seen but they are not included because of failure to culture the wounds on admission. Twenty-six cases of gas gangrene were caused by *Clostridium perfringens*, while 1 case was caused by *Cl. septicum*.

It is well known that a smear from a fresh wound does not provide a reliable picture of the bacterial flora of the wound. Cultures must be depended on for accurate information. In the case of anaerobic infections it is necessary that this information be obtained early, before the infection gets out of control, in order to institute early treatment. Those patients from whose wounds anaerobes were cultured were observed most carefully so that clinical signs of infection were detected as soon as they made their appearance. The inestimable value of the information obtained is illustrated by the following case report.

CASE REPORTS

Case 1.—A young Marine was wounded in both legs by shell fragments at 0800. The wounds were dressed and on the following day the patient was admitted to this hospital ship. The left leg and foot were swollen, edematous, and tender. Six inches below the knee on the medial aspect of the leg there was a wound 3 cm. in diameter. A metallic foreign body was palpable just below the patella. The x-ray plate revealed a large fragment of metal embedded in the medial portion of the upper end of the tibia, with an incomplete fracture.

Under pentothal anesthesia an incision was made over the foreign body, and extended to the wound. Much foul, liquefied blood escaped under great pressure. A culture was taken, the foreign body removed, the wound left

open and a cast applied. A window was cut in the cast for purposes of observation.

The presence of *Clostridium perfringens* was reported by the laboratory before clinical gas gangrene was suspected. After consultation, amputation was performed and the patient made an uneventful recovery. Pathologic and bacteriologic examination of the specimen confirmed the diagnosis of gas gangrene. Without the aid of the laboratory, amputation would have been deferred at least 24 hours and the chances of recovery would have been considerably compromised.

Aerobic organisms were cultured from 120 wounds (89.55 percent), and in only 14 wounds (10.45 percent) were the cultures negative. *Staphylococcus albus* was found most frequently. In 51 of the 134 wounds cultured for aerobes more than one species of aerobe was found.

With this bacteriologic evidence it must be said that wound infection was frequent. It remained localized, however, and only in one case did extension of the infection present a serious complication. The case report is as follows.

Case 2.—A lieutenant, U.S.M.C., had been wounded in the right hip. On admission to this hospital ship the patient was obviously very ill. The temperature was 102° Fahrenheit. The hip spica was removed and a very large, necrotic, foul, grossly infected wound of the right hip was found. The hip joint, the trochanter of the femur, and the ilium were involved. The necrotic tissue was removed, the wound was dressed, and a hip spica was applied. Sulfadiazine sufficient to obtain a blood level of 9.3 mg. percent was given by mouth. One million units of penicillin were administered intramuscularly, blood transfusions and plasma were given. The patient's temperature reached 105° F. and he died 4 days after admission. *Staphylococcus aureus* was cultured from the blood stream.

There is a growing skepticism concerning the value of the local implantation of sulfonamides in an effort to prevent and control infection. The first-aid treatment given to a high percentage of battle casualties consists of the implantation of sulfanilamide powder and the application of a sterile dressing. A qualitative chemical test performed on serum from the wounds of patients admitted to this hospital ship, or on macerated tissue removed at debridement, revealed the presence of a sulfa drug in 60.83 percent of the wounds from which aerobic organisms were cultured, and in 57.14 percent of the wounds from which anaerobes were cultured. Although sulfanilamide locally implanted certainly is not bactericidal, its value as a bacteriostatic agent is difficult to evaluate.

The wounds of two patients from which *Clostridium perfringens* was cultured were constantly irrigated with azochloramid solution, and adequate doses of sulfadiazine were given orally. In addition, one patient received 640,000 units of penicillin intramus-

cularly. After 9 days of this therapeutic regimen, cultures of the wounds still yielded *Cl. perfringens*, although neither patient developed clinical gas gangrene. This would seem to re-emphasize the well-known fact that chemical sterilization of a wound is practically an impossibility.

SUMMARY

A bacteriologic study of 161 unselected but severe wounds has been made on board a hospital ship. Fragments from shells or grenades caused the wounds in 53 percent of the patients, while bullets were responsible for the wounds in 33.5 percent. Eighty-three, or 51.6 percent, of the patients were seen within the first 24 hours.

Aerobes were present in 89.55 percent of the 134 wounds which were cultured for aerobic organisms, while 14 wounds yielded negative cultures. *Staphylococcus albus*, the aerobe most frequently present, was cultured from 62 wounds. In only one instance in this group of patients was extension of the aerobic infection a serious complication. This patient succumbed to a *Staphylococcus aureus* septicemia despite large doses of sulfadiazine and penicillin, and supportive measures.

Anaerobes were present in 48.12 percent of 160 wounds. Twenty-seven (35 percent) of these patients developed clinical gas gangrene. One patient whose admission wound culture was negative for anaerobic organisms later presented clinical evidence of gas gangrene and positive cultures were obtained. Those patients whose wound cultures yielded pathogenic anaerobes were observed carefully and early treatment was instituted when clinical signs of infection made their appearance. *Clostridium perfringens* was present in 57 wounds, while unclassified proteolytic anaerobes were cultured from 24 wounds.

In 51 wounds which yielded positive cultures of anaerobes, and which were tested for the presence of a sulfa drug, 86.2 percent contained a sulfonamide. Likewise 80.2 percent of 91 wounds from which aerobes were cultured contained a sulfonamide.

In two instances oral sulfadiazine therapy and continuous irrigations of the wounds with azochloramid solution failed to eliminate *Clostridium perfringens* in 9 days. One of these patients received penicillin.

ACKNOWLEDGMENT.—We are indebted to Archibald M. Ecklund, Commander (MC) U.S.N.R., who was in charge of the laboratory, for many valuable suggestions, and to Victor Fink, Pharmacist's Mate, first class, U.S.N.R., for the technical work.

ENDOCRINOLOGIC ASPECTS OF RECRUITING

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The purpose of this article is to bring to the attention of the recruiting officer the importance of proper diagnosis and classification of endocrine dysfunction in relation to disqualification for the Naval service, this for the purpose of securing satisfactory recruiting statistics. At the start it must be stated that a statistical study is readily confused by the lack of a uniform system of classification of the endocrinopathies. War has curtailed much of the study these matters deserve.

During 2 years of physical examination of recruits at the Marine Recruiting Station, Philadelphia, approximately 25,000 young men were examined. The age range of recruits was wide, 17 to 30 years for regulars, 17 to 34 years for reservists, and in addition there were a few men between 27 and 50 years who enlisted as specialists or for guard duty in the United States.

The chief causes of rejection for enlistment in the Marine Corps during this period are shown in table 1.

TABLE 1.—*Chief causes of rejection for enlistment in the Marine Corps among applicants examined*

Causes	1941		1942	
	No.	Percentage	No.	Percentage
Color blindness.....	186	3.2	596	3.8
Errors of refraction.....	355	6.3	1,207	7.6
Spinal curvature.....	20	.34	145	.93
Flat feet.....	191	3.2	768	4.8
Defective physical development.....	40	.78	107	.7
Obesity.....	13	.22	94	.66
Overheight.....	1	.017	12	.077
Underheight.....	20	.34	90	.58
Underweight.....	13	.22	232	1.4
Defective teeth and gums.....	350	6.2	1,510	9.7
Disease of ductless glands and spleen.....	43	.73	112	.72
Heart affections.....	179	2.8	459	2.9
Total applicants examined.....	5,900		15,495	

The classifications in this table are a practical wartime division of defects occurring among applicants, but minimize the importance of the endocrine diseases. Many of these classifications represent endocrine manifestations, such as defective physical development, obesity, and disproportionate measurements.

When the examiner views the nude applicant at the start of the examination, he makes a quick estimate as to whether the applicant belongs to the desirable athletic and hypersthenic type or to the asthenic and pyknic type which is not desirable. Some of the growth disturbances, such as (pituitary or thyroid) acromegaly are disqualifying for enlistment by reason of their facial or outward appearance as well as for the constitutional disease existing. Gigantism or dwarfism disqualifies an applicant by reason of the difficulty in fitting with a stock-size uniform as well as by reason of such unusual stature constituting a mark for the enemy sharpshooter.

Recruiting regulations give a range of 64 to 74 inches in height limits. If the applicant is sound physically, weighing at least 125 pounds, and not more than 20 pounds below the standard table of weights, he is acceptable. If he is overweight and not obese, but with fat well distributed, can wear stock clothing and is sound physically, he is acceptable.

If, in addition to odd measurements, signs of dyspituitarism, or thyroid, parathyroid, adrenal or pancreatic involvement are evident, the proper diagnosis must be searched for in order to keep our statistics pure. Signs of dyspituitarism appear as growth, weight, and sexual changes, loss of libido, hypogenitalism, hypo- or hypertension, girdle type obesity, sparse growth of hair, and upper sagittal measurement usually greater than lower. It is always difficult to secure a history from the recruit of subjective symptoms which occur in dyspituitarism, such as headache, weakness, rheumatoid pains, personality changes, and visual disturbances. Pituitary infantilism involves underdevelopment of all organs and systems without adiposity, and is probably due to an unlimited underfunctioning of the eosinophilic elements of the anterior pituitary lobe. The Lorain-Lévi type of dwarfism is characterized by infantile proportions without mental retardation.

Fröhlich's syndrome, which has begun in early childhood, may be noted by retarded skeletal development, obesity, and small or infantile external genitalia. The testes may fail to descend.

Secondary sex characteristics are only partially developed. The obesity is of the female distribution, most noticeable at the shoulders, breasts, lower abdomen, hips and thighs, while the arms and legs are thin.

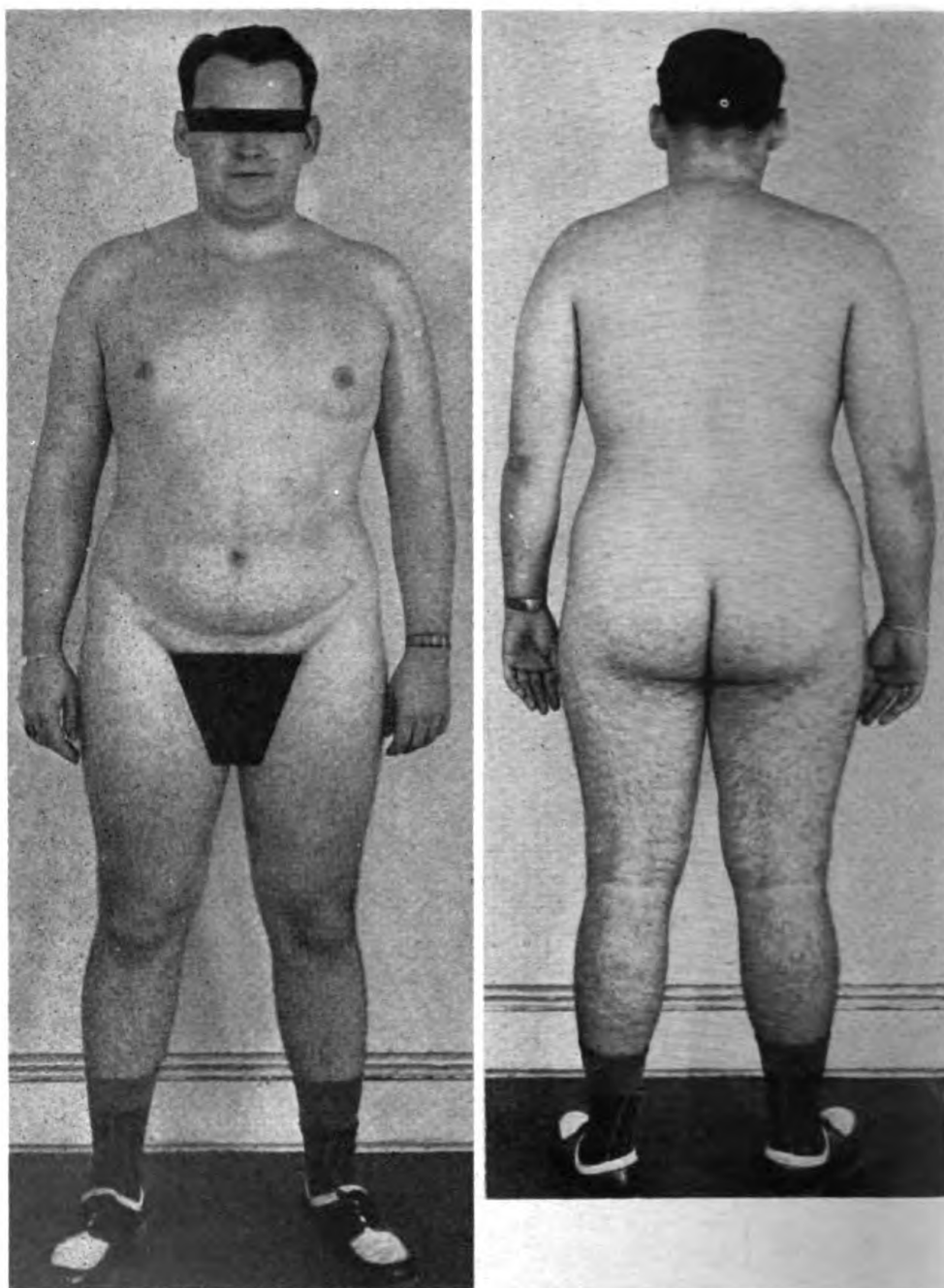
In adolescent Fröhlich's syndrome, there may be skeletal overgrowth and normal genitalia, but the secondary sex characteristics are reduced or absent. The unequal bone growth is noted by relatively short extremities in relation to height. A common complaint is headache. The disposition is placid, and intelligence average.

There is rarely clinical evidence of neighborhood pressure signs in Fröhlich's syndrome, and x-ray examination of the sella turcica shows no abnormality. Thus the view is held that the hypothalamus is involved rather than the pituitary. Fröhlich's syndrome should not be diagnosed as such when only obesity and only "apparent" hypogonadism are present. However either undescended testicle or gynecomastia alone, in the absence of any other sign of endocrinopathy, constitutes a cause for rejection for enlistment. Cryptorchidism constitutes a potential source of vital force deficiency. Gynecomastia becomes a criterion of undesirability in a recruit as a symptom and also in its being a source of ridicule, and possible abuse at the hands of a sexual pervert. These Fröhlich's type individuals are lethargic, slow, antisocial, and are peculiarly unsuited to military requirements in their behavior and personality.

A type of dyspituitarism seen more frequently was classified as pituitary basophilism (Cushing's syndrome), although x-ray studies should have been made to confirm this diagnosis. These men have the feminine type of obesity, underdeveloped genitalia, female outline of pubic hair, and hypertension and they show well-marked purplish striae over the skin of the lower abdomen or hips similar to the striae observed in adrenocortical hypertrophy.

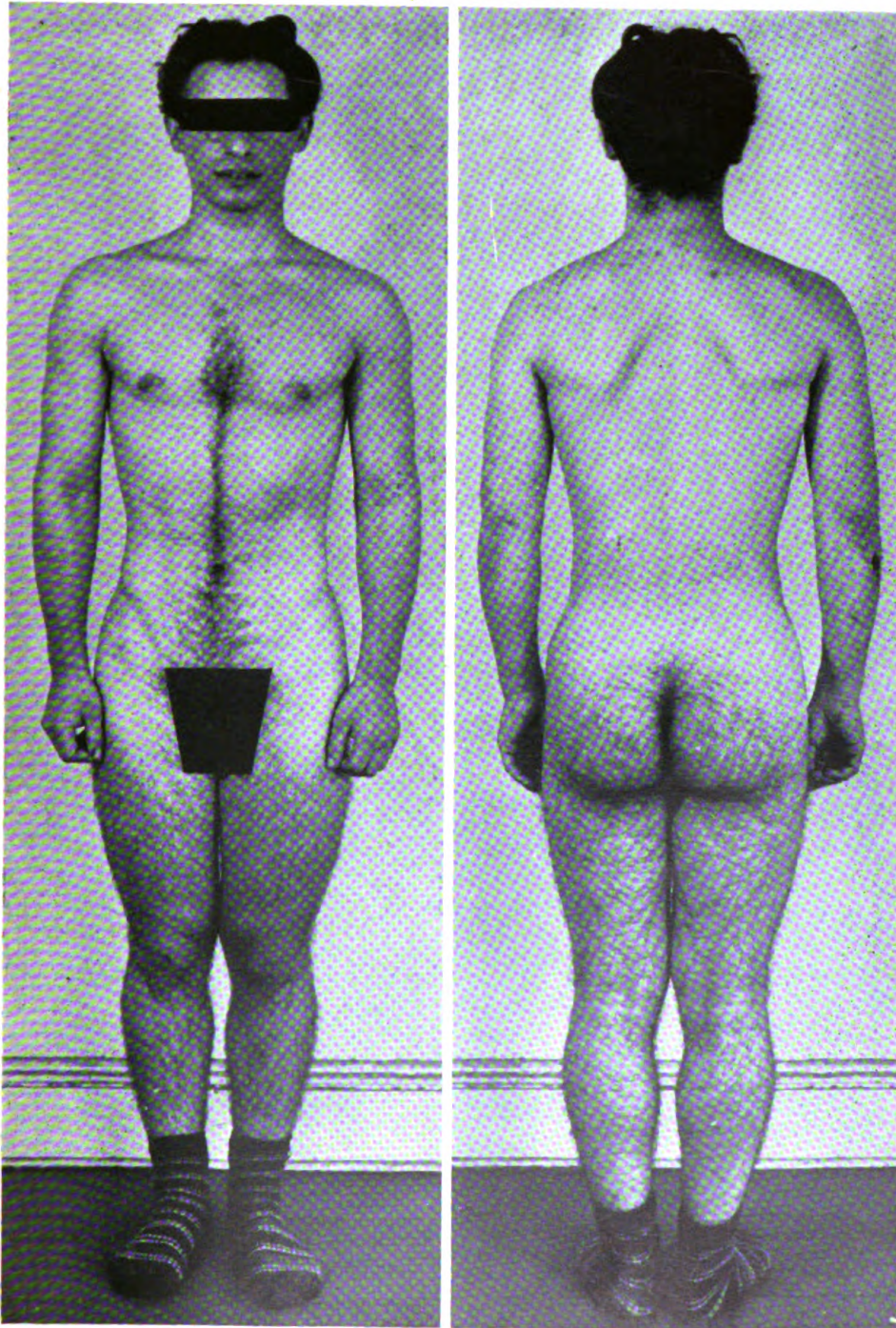
Obesity and hypogonadism may be primary in the testis. There was neither opportunity here for urinary assay for androgens, nor to determine the biophysiologic effect of testosterone on these applicants. The outstanding physical feature of the eunuchoid, aside from the tall stature and sexual hypoplasia, is the lack or absence of secondary sexual characteristics. He may be lean or obese. All have a disproportionally large extremity growth. The developmental deficiency and the lack of energy of eunuchoidism result from the associated protein and electrolytic or blood chemistry imbalance which occurs in testosterone deficiency. Other causes of hypogonadism must be kept in mind, such as mumps, tuberculosis, trauma, new growths, nutritional deficiencies, thyroid deficiencies, and such embryonic developmental defects as occur in true embryonal cryptorchidism and hermaphroditism. These young men may have some mental and scholastic difficulties. The condition must be differentiated from hypogenitalism, accompanied by sluggish maturity and psychologic and associated constitutional inadequacy.

Endocrine disturbances affecting the visual apparatus are rarely found among recruits. Among these rare visual apparatus defects are found an early Simmond's disease, showing an opacity of the cornea, and a latent parathyroid disease, showing an opacity of the lens; both are trophic in nature. Even more rarely, lens



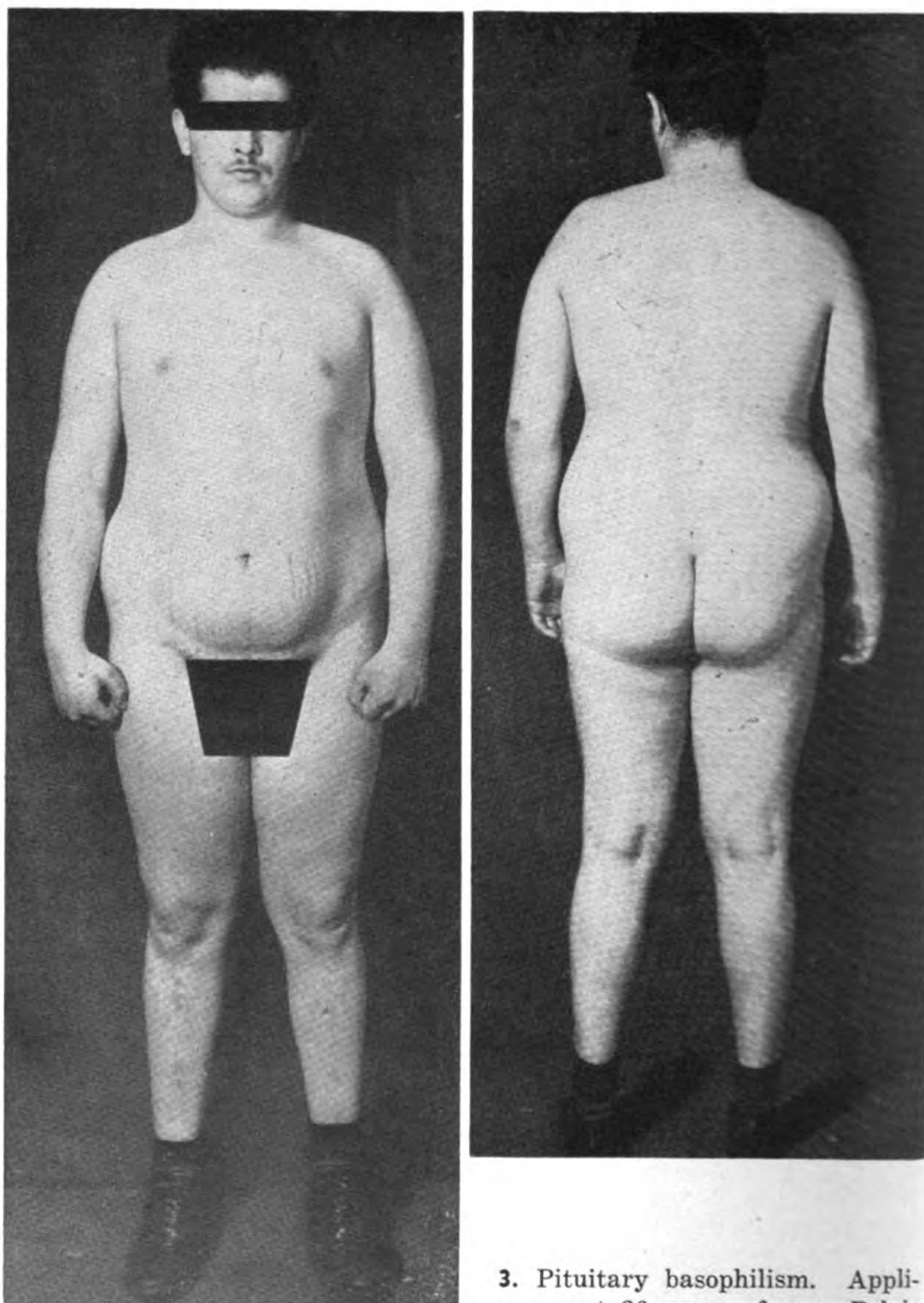
1. Early basophilism. Applicant 22 years of age. Obesity of trunk, especially pelvic girdle. Gynecomastia, moderate. Female type escutcheon. Lineae atrophicae over lower lateral abdomen. Blood pressure 162/104. Rejected for U. S. Marine Corps.

changes of early cataract in diabetes are seen. The ocular palsies of pituitary tumor origin must be watched for; a complaint of gradually failing vision, with a background of long-standing headache and loss of libido in a young adult should receive more extensive observation. These early pituitary tumors are easily missed.



2. Pituitary adrenal dysfunction. Applicant 24 years of age; $62\frac{1}{2}$ inches in height. Upper measurement $34\frac{1}{2}$ inches (vortex to symphysis pubis). Lower measurement $27\frac{1}{2}$ inches (symphysis to sole). Span $64\frac{1}{2}$ inches. Hirsutism general + + +. Myopia, headaches. Frequent nocturnal emissions. Libido + + +. Blood pressure 158/110. Rejected for U. S. Marine Corps.

The applicant may fail to show loss of visual acuity, and no optic atrophy may show by ophthalmoscopy. Despite this lack of evi-

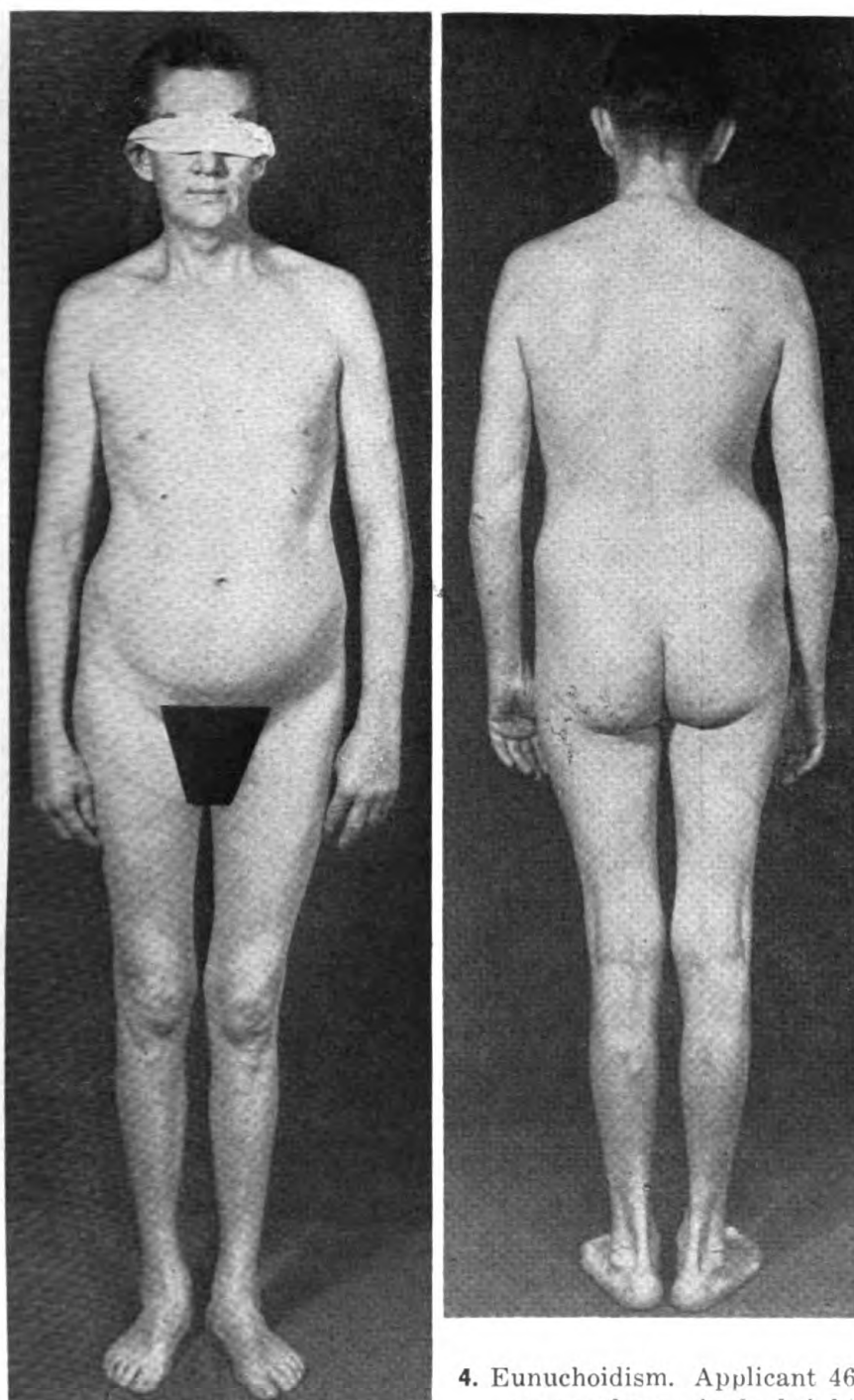


3. Pituitary basophilism. Applicant 26 years of age. Pelvic

girdle obesity and pot belly. Female escutcheon. Small genitalia. Lineae atrophicae (purplish). Genu valgum. Scoliosis. Slender forearms, wrists, lower leg, and ankles. Libido diminished. Blood pressure 164/98. Rejected for U. S. Marine Corps.

dence, the visual fields and a skull x-ray examination will provide proof for rejection for enlistment and the need of surgical or x-ray treatment.

The importance of diagnosis of the endocrinopathies is evident in a study of tables 2 and 3 taken from Annual Reports of the



4. Eunuchoidism. Applicant 46 years of age, single, height

68½ inches, weight 130 pounds. Chest measurement 33-35 inches; waist 30 inches. Upper measurement (vortex to symphysis pubis) 32½ inches. Lower measurement (symphysis pubis to sole) 36 inches. Span 69¾ inches. Penis less than 2 inches. Testes ½ inch—almost imperceptible. Scrotum 1¼ inches by ¼ inch. He still has erections but has lost libido.

Surgeon General for 1938, 1939, and 1940, showing morbidity caused by these diseases. For instance there were 22 patients with

diseases of the ductless glands invalided from the Navy in 1938, 21 in 1939, and 44 in 1940. This morbidity would have been higher if endocrine manifestations, such as defective physical development, diabetes insipidus, enuresis, headache, acne, and obesity had been listed under endocrine diseases.

TABLE 2.—*Statistics from the Annual Report of the Surgeon General for the years 1938, 1939, and 1940*

Class IV. Diseases of ductless glands and spleen	1938	1939	1940
Original admissions.....	63	73	98
Re-admissions.....	20	16	20
Cases remaining from previous year.....	22	24	25
Cases complicating other conditions.....	2	1	1
Patients invalided from service in this class.....	22	21	40
Cases existing prior to enlistment.....	1	2	12

TABLE 3.—*Statistics from the Annual Report of the Surgeon General for the years 1938, 1939, and 1940*

Disease	1938			1939			1940			Total		
	New adm.	Adm. rate per 100,000	Sick days per case	New adm.	Adm. rate per 100,000	Sick days per case	New adm.	Adm. rate per 100,000	Sick days per case	New adm.	Adm. rate per 100,000	Sick days per case
Diabetes mellitus.....	34	24	79.8	31	21	81.8	52	26	72.5	117	23.7	78.0
Hyperthyroidism.....	11	8	69.6	14	9	72.9	12	6	56.1	37	7.7	66.2
Goiter, simple.....	9	6	47.9	10	7	48.1	6	3	27.1	25	6.3	41.0
Hypothyroidism.....	7	5	55.2	9	6	73.9	9	4	54.0	25	5	61.0
Goiter, exophthalmic	0	0	76.0	3	2	60.5	6	3	47.4	9	1.7	61.3
Goiter, adenomatous	0	0	0	2	1	53.0	4	2	49.0	6	1	51.0
Dyspituitarism.....	1	0.72	30.0	1	0.67	36.5	3	1	13.8	5	0.8	26.7
Hypopituitarism.....	0	0	0	0	0	15.0	0	0	37.0	0	0	26.0
Myxedema.....	0	0	7.0	0	0	0	0	0	23.0	0	0	15.0
Dysinsulinism.....	0	0	93.0	0	0	0	2	1	89.3	2	3	91.1

Now that the war is over, more careful classification of endocrine disease should be made by the recruiting officer so that rejections made under the heading of, for example, "obesity" would indicate the glandular defect that underlies it if present. Simple obesity is not alone a cause for rejection, inasmuch as overweight young men under Naval training rapidly lose this excess weight.

About one percent of all applicants examined in the period covered by this report showed definite endocrine defects.

Wartime, with its attendant rush, gave little opportunity for fine diagnostic procedure. Some of the rejections shown in this report no doubt slipped into the "symptom basket" of spinal curvature, defective physical development, obesity, flat feet, or defective teeth and gums. These "symptomatic" defects, in themselves common causes of rejection, are so frankly obvious that these men are taken out of the line early in the routine of examination and thus fail to receive the deeper scrutiny required to uncover the endocrine background.

Many of these individuals would be overlooked, even without the rush, unless the examiner were endocrine conscious. Alertness on the part of examiners to detect endocrinopathes will save wasted man-hours of training, many sick days, and subsequent medical discharge and pensioning.

Finally a plea is made for proper diagnosis and classification of endocrine dysfunction as related to disqualification for the Naval service in order to assemble recruiting statistics which will have proper meaning and value.



SODIUM SALICYLATE EFFECT ON BLOOD

The administration of sodium salicylate with sodium bicarbonate in therapeutic doses to patients with rheumatic fever is followed by an increase in the Quick prothrombin time. In none of the cases reported, however, were any hemorrhagic manifestations noted following the administration of salicylates. Long continued high dosage of salicylates is followed by a light reduction in the hemoglobin content and erythrocyte count. The leukocyte count is unaffected by salicylates, as is the urine.—BUTT, H. R.; LEAKE, W. H.; SOLLEY, R. F.; GRIFFITH, G. C.; HUNTINGTON, R. W.; and MONTGOMERY, H.: Studies in rheumatic fever; I. Physiologic effect of sodium salicylate on human being, with particular reference to prothrombin level of blood and effect on hepatic parenchyma. J.A.M.A. 128: 1195-1200, August 25, 1945.



MEASLES ANTIGEN IN THE MOUTH

In the mucus of the oral cavity of measles patients at a certain stage of the disease there is sufficient measles antigen to produce complement-fixation. By intranasal instillation in white mice it is possible to pass the measles antigen into the lungs. The complement-fixation reaction with prolonged cold incubation, using such oral washings or emulsions of infected mouse lungs as antigens, could be utilized for specific titration of anti-measles sera. This reaction is fully specific and sufficiently sensitive; it discloses a significantly larger quantity of "reagents" in the serum of convalescents in comparison with serum of adult humans and the complete absence of specific reagents in the serum of rabbits.—ORLOV, G. A.: Specific titration of anti-measles serum by complement-fixation. Am. Rev. Soviet Med. 2: 531-536, August 1945.

PROTHROMBIN LIVER FUNCTION TEST

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Commander (MC) U.S.N.R.

Accuracy in distinguishing between functional disturbances of the liver and organic liver disease has been difficult by clinical methods in common use. In 1941 Andrus¹ advocated the use of vitamin K parenterally, with prothrombin estimation before and after the injection, as a method of measuring liver function. In his series of 40 cases this test proved to be extremely accurate in differentiating jaundice of intrahepatic origin from that of extrahepatic origin. This communication deals with the results of this test in 32 cases of liver disease.

In each case the degree of jaundice at the time of the prothrombin liver function test was established by performing an icterus index on fasting serum. Following the initial prothrombin estimation, 2 mg. of 2-methyl-1-4-naphthoquinone was administered intramuscularly. At the expiration of 48 hours a subsequent prothrombin estimation was performed. The method² used for estimating prothrombin was a modification of Quick's method, using Russell viper venom as the thromboplastic substance.

Twenty-three of the cases were also studied by the bromsulfalein test.

In all instances the initial prothrombin level was decreased below normal. For purposes of analysis a normal response was indicated when the plasma prothrombin level increased 10 percent or more 48 hours following the parenteral administration of 2-methyl-1-4-naphthoquinone. The table reveals the initial prothrombin time, the prothrombin time 48 hours after the parenteral injection, the type of response, the icterus index at the time the functional test was performed, the results of the bromsulfalein test, and the final clinical or anatomic diagnosis.

In 14 of 16 cases of infectious hepatitis the response of the prothrombin liver function test was normal. These cases were mild, with an average hospital stay of 18 days, followed by com-

¹ ANDRUS, W. DEW.: Newer knowledge of vitamin K. Bull. New York Acad. Med. 17: 116-134, February 1941.

² PAGE, R. C., and RUSSELL, H. K.: Prothrombin estimation using Russell viper venom; simple modification of Quick's method. J. Lab. & Clin. Med. 26: 1266-1270. May 1941.

plete recovery and return to duty. The bromsulfalein test in these cases revealed no dye retention. In two instances of infectious hepatitis the prothrombin liver function test was abnormal and the bromsulfalein test revealed 55-percent and 90-percent dye retention respectively. Both of these patients had protracted septic courses which necessitated their return to the States for further study and disposition.

Five patients with extrahepatic jaundice gave normal prothrombin liver function results, and 13 with organic intrahepatic disease gave abnormal results.

In two instances the final diagnosis was established at operation and in nine instances at autopsy. Surgical intervention in one case established a diagnosis of choledocholithiasis with cholangitis. It was impossible to remove all of the stones because they extended into the hepatic ducts. After a protracted illness the patient developed liver abscesses, and another prothrombin liver

Case number	Initial prothrombin time (seconds)	Prothrombin time following vitamin K (seconds)	Prothrombin response	Icterus index	Bromsulfalein test	Clinical (1) or anatomic (2) diagnosis
1	55	30	Normal	61	Negative	Infectious hepatitis (1)
2	61	41	Normal	72	Negative	Infectious hepatitis (1)
3	43	30	Normal	40	Negative	Infectious hepatitis (1)
4	71	49	Normal	159	Negative	Infectious hepatitis (1)
5	53	45	Normal	55	Negative	Infectious hepatitis (1)
6	48	33	Normal	56	Negative	Infectious hepatitis (1)
7	38	32	Normal	42	Negative	Infectious hepatitis (1)
8	59	39	Normal	54	Negative	Infectious hepatitis (1)
9	50	37	Normal	66	Negative	Infectious hepatitis (1)
10	42	28	Normal	96	Negative	Infectious hepatitis (1)
11	38	25	Normal	71	Negative	Infectious hepatitis (1)
12	46	32	Normal	81	Negative	Infectious hepatitis (1)
13	37	29	Normal	60	Negative	Infectious hepatitis (1)
14	41	29	Normal	93	Negative	Infectious hepatitis (1)
15	51	49	Abnormal	143	90 percent dye ret.	Infectious hepatitis (1)
16	79	75	Abnormal	133	55 percent dye ret.	Infectious hepatitis (1)
17	127	72	Normal	96	.....	Icterus gravis (1)
18	50	37	Normal	44	Negative	Chr. cholecystitis with lithiasis (1)
19	67	45	Normal	196	.....	Stone in ampulla (1)
20	28	20	Normal	48	Negative	Infectious mononucleosis (1)
21	72	44	Normal	10	Negative	Gastrocolic fistula (carcinoma) (2)
22	86	92	Abnormal	77	Negative	Acute necrosis—liver (sulfadiazine) (2)
23	91	110	Abnormal	156	.....	Suppurative cholangitis with liver abscesses (2)
24	160	171	Abnormal	60	Negative	Toxic necrosis liver (sulfanilamide) (2)
25	132	128	Abnormal	72	.....	Post-vaccinal liver necrosis (2)
26	72	87	Abnormal	162	.....	Toxic necrosis liver; sulfanilamide in abdomen (2)
27	80	77	Abnormal	31	.....	Eclampsia (2)
28	72	70	Abnormal	12	.....	Methyl alcohol poisoning with focal liver necrosis (2)
29	32	29	Abnormal	18	10 percent dye ret.	Cirrhosis (1)
30	35	32	Abnormal	15	12 percent dye ret.	Cirrhosis (1)
31	37	35	Abnormal	21	21 percent dye ret.	Cirrhosis (1)
32	66	60	Abnormal	212	.....	Choledocholithiasis with cholangitis and liver abscesses (2)
	104	99	Abnormal	235	.....

function test after his course became septic revealed evidence of more extensive liver disease, the initial prothrombin level being lower and the response negligible. In all types of liver disease the test was valuable in estimating the degree of liver damage and was therefore helpful in prognosis.

CONCLUSIONS

1. The prothrombin liver function test is a simple and accurate means of distinguishing between jaundice due to extrahepatic conditions and that due to severe intrahepatic disease.
2. It serves to indicate the degree of liver damage and hence is of value in estimating prognosis.



BACTERIAL EFFECT OF ALCOHOL ON A DRY SURFACE

The effective range of strengths of alcohol for the killing of nonsporing bacteria is between 90 percent and 50 percent. Ninety-five percent strength and above is partially ineffective, 100 percent being decidedly so. The lower surface tension of stronger alcohol mixtures suggests that the upper limits of this effective range may be preferable to the lower, though against this must be considered the more pronounced fixing effect of strong alcohol, which may cause the coagulation of an exudate and the consequent protection of living organisms within the coagulum so formed.—ARCHER, G. T. L.: Bactericidal effect of mixtures of ethyl alcohol and water. *Brit. M. J.* 2: 148-151, August 4, 1945.



CALCIUM CARBONATE IN ORAL PENICILLIN

The average serum levels following the administration of 100,000 units of calcium penicillin with 2 gm. of calcium carbonate are approximately twice as high at all test periods as the average serum levels following the administration of 100,000 units of calcium penicillin alone. The average serum levels obtained with the penicillin-sodium citrate combination are also generally higher than those obtained by the administration of penicillin alone. The average serum levels obtained following the administration of penicillin with dry sodium phosphate buffer, aluminum hydroxide, magnesium trisilicate, or magnesium hydroxide are all inferior to those obtained by the administration of penicillin alone. Therefore the latter compounds in the dry form do not appear to be indicated as an aid to the oral administration of penicillin.—SEEBERG, V. P., and COLLEN, M. F.: Calcium carbonate as antacid for oral penicillin. *Science* 102: 225-227, August 31, 1945.

CLINICAL NOTES

ALLERGIC REACTIONS TO PENICILLIN THERAPY

REPORT OF CASES

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and

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Complications from the use of penicillin have been few. However they may arise, and because of the wide use of penicillin in the military services and its increasing use in civilian life, complications of importance should be reported. In the three cases cited here, similar allergic manifestations followed the intramuscular administration of penicillin sodium. None of the patients is asthmatic or is known to have had any previous allergic manifestations.

The penicillin sodium employed was known to be from the same lot in two instances, and was thought to be from the same lot in all three instances. The mode of preparation and administration is a standard procedure in this Naval activity and was not deviated from in this group of patients.

CASE REPORTS

Case 1.—A 45-year-old man had a sliding pedicle skin graft operation on 15 May 1945 for a chronic infected ulcer over the medial aspect of the heel. The ulcer had been prepared for surgery by the use of tyrothricin wet dressings. Penicillin sodium therapy, 20,000 units intramuscularly, was instituted on 10 May and continued until 17 May, a total of 1,260,000 units being given. His temperature was elevated to 101° F. on the day following surgery and remained elevated, gradually decreasing to 99.5° F. on 17 May. The pulse rate was 140 on the day following surgery and remained accelerated throughout the course of penicillin therapy, the average for the whole period being one hundred.

On 21 May there was swelling of the hands, feet, and face, with elevated erythematous lesions on the arms and legs, accompanied by intense itching. Treatment consisted of calcium lactate, 1 grain four times daily, calcium gluconate, 10 cc. intravenously twice daily, ephedrine, $\frac{3}{8}$ grain, with sodium amytal, $\frac{3}{4}$ grain three times daily. Indicated laboratory studies showed normal results. All swelling and lesions had subsided by 24 May.

Case 2.—A young man, 19 years of age, had a split-skin-grafting operation for a large chronic ulcer over the posterior aspect of the left leg on 16 May. Sulfanilamide and sulfathiazole crystals in the proportion of 2 to 1 respectively were sprinkled over the graft at the time of surgery. Tyrothricin wet dressings had been applied several days prior to surgery. Penicillin sodium therapy, 20,000 units intramuscularly, had been started on 15 May and was continued until 20 May, a total of 820,000 units being given. The patient's temperature was elevated on the day of surgery, averaging 99.5° F., and his pulse rate was 100 per minute and remained so throughout the course of penicillin therapy, returning to normal on discontinuing the drug.

On 22 May, large, elevated, erythematous lesions appeared over the trunk, with intense itching, and there was considerable swelling of the face and hands. The lower extremities presented no swelling. The treatment given was similar to that reported in case 1; however in this instance the itching was relieved by repeated intravenous use of calcium gluconate. This reaction had completely subsided by 28 May.

Case 3.—The third case is presented in more detail because of the persistence of the reaction and its progression to a point of concern for the life of the patient. The patient, a 40-year-old male, had a hemilaminectomy and bone-grafting operation on 1 May. Penicillin sodium, 20,000 units intramuscularly, was given on 1 May, and was repeated every 3 hours until 10 May; the total amount administered being 1,480,000 units. The patient's temperature was elevated following surgery and remained so, averaging 100° F., and the pulse rate was accelerated to between 90 and 100 beats per minute throughout the course of penicillin therapy. On 11 May, the day following discontinuation of penicillin, the patient's temperature and pulse rate became normal.

On 15 May the temperature was again elevated and the pulse rate accelerated. This was concomitant with the appearance of discrete erythematous lesions of the forearms and legs, and onset of edema of the hands. All lesions were progressive. On 18 May, edema of the eyelids and lower extremities appeared. The multiple giant urticarial lesions persisted, with alternating regression and recurrence until 24 May. On this day the temperature was 102° F., the pulse rate 140 per minute, the blood pressure 70/54, and the patient was in moderate shock. There was some nausea and vomiting of blood-stained material. The giant urticarial lesions progressed until they were almost solid over the torso and extremities.

The patient was given 50 cc. of 50-percent dextrose followed by 1,000 cc. of 5-percent dextrose in saline, and this was followed by a second 50 cc. of 50-percent dextrose. There was immediate response to this therapy and by the following day the edema was reduced by one-half and the lesions were fading. After 2 days the patient's appearance was normal. The rest of the treatment of this patient was as previously noted in cases 1 and 2, but in addition the patient received epinephrine in oil on 22 and 23 May with no apparent effect.

SUMMARY

In all three cases the temperature remained elevated and the pulse rate accelerated throughout the course of penicillin therapy. There was not enough apparent infection in any of these cases to account for this reaction, and as soon as penicillin was discontin-



Photographs showing lesions in case 3.

—Official U. S. Navy Photos.

ued the temperature and pulse rate promptly returned to normal.
There were no allergic manifestations during the administration

of penicillin. The onset of allergic manifestations was delayed from 2 to five days after the penicillin was discontinued, and in all instances was characterized by edema of the face and hands, and by generalized giant urticarial lesions.

No dramatic response was noted from the use of the usual measures employed in treating allergic reaction; however in one instance itching was somewhat relieved by the intravenous use of 10-percent calcium gluconate.

Since this report was prepared, a fourth patient in this hospital has had a reaction similar to that in the cases described following the use of penicillin. In this last case 50 cc. of 50-percent dextrose was administered on the day of onset, and the edema of the face and hands was lessened within a few hours and had disappeared in 24 hours. The giant urticaria was unaffected.

In conclusion, it is believed that the allergic reactions to penicillin described in this report resulted from some material used in the preparation of the drug.



FLUORESCENT LIGHT EFFECT ON VISION

The ultraviolet energy from clear blue summer skylight is three to four times as great per foot-candle as fluorescent light. Light from fluorescent lamps resembles daylight more closely than that from tungsten-filament lamps. This color resemblance to daylight is a desirable quality. Infra-red energy found in fluorescent lighting as now manufactured produces no known physiologic effect except that due to heating. Fluorescent light generates less heat per candlepower than tungsten lamps.—COUNCIL ON INDUSTRIAL HEALTH: Effect of fluorescent light on vision. J.A.M.A. 128: 1229, August 25, 1945.



ORAL MICROCRYSTALLINE SULFADIAZINE

Patients receiving by mouth suspensions of microcrystalline sulfadiazine (3 gm.) showed significantly higher concentrations of sulfadiazine in serum during the first 6 hours following its ingestion than did those who received ordinary sulfadiazine. The excretion of sulfadiazine in the urine was likewise significantly higher during this period. These observations indicate that microcrystalline sulfadiazine is absorbed more rapidly than is ordinary sulfadiazine.—REINHOLD, J. G.; PHILLIPS, F. J.; and FLIPPIN, H. F.: Comparison of behavior of microcrystalline sulfadiazine with that of ordinary sulfadiazine in man. Am. J. M. Sc. 210: 143-147, August 1945.

HYPERTROPHIC GINGIVITIS OF MOUTH BREATHING

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Chronic, hypertrophic gingivitis of the young, adenoidal mouth breather has been seen in sufficient numbers at this activity to warrant an attempt at classification and to suggest a mode of treatment.

Such a patient, now in the age group of from 17 to 20, has successively posed problems to the pediatrician, rhinologist, and the orthodontist. In the Navy he has become a periodontal difficulty.

It must be stated that many mouth breathers escape with little or no soft-tissue inflammation. Those whose tissue response is exuberant or hypertrophic, require the attention of the dental officer.

The two cases selected are typical and suggest two different modes of treatment.

CASE REPORTS

Case 1.—An air-combat crewman arrived at the dispensary with other members of his class for a routine dental examination. He had the typical adenoidal facies; vacant stare, underdeveloped nose and bowed upper lip. Intra-orally, the same molding force created a high vault. There was a deep overbite.

A tough, fibrous, overgrowth of gum tissue existed anteriorly from No. 22 to No. 27. Beyond this point, where the cheeks protected against drying, the mucosa was normal.

Internal to the area of fibrous tissue, the gum was hyperemic and edematous where the inflammation was caused by tartar deposits.

The maxillary gingiva was affected, but in a different manner. Internally the interproximal gingiva was inflamed from molar to molar but with no hypertrophy. Externally from No. 6 to No. 11, the gum appeared toughened, with a degree of swelling that only obliterated the mucous stippling (fig. 1).

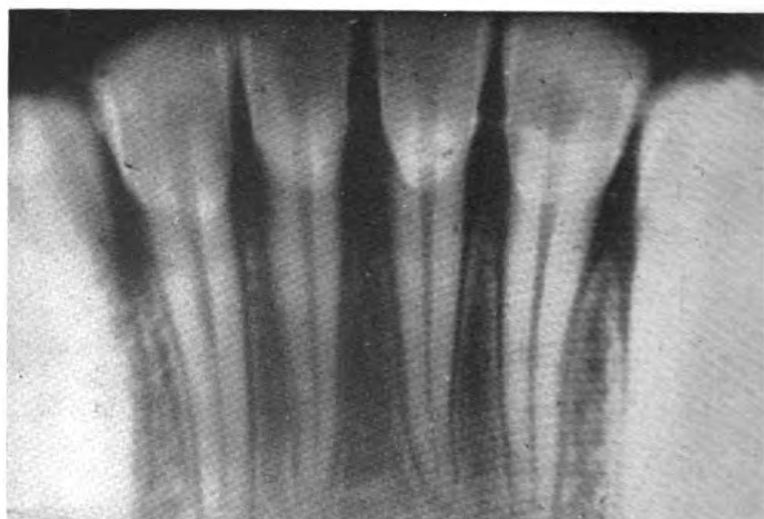
The pathologist returned a diagnosis of "chronic, nonspecific, exudative inflammation." Mention was made of an area where the "vessels are compressed by an overgrowth of fibrous tissue."

For the amount and degree of gingivitis, the x-ray film revealed little bone absorption (fig. 2). A slight area can be noticed at the very tips of the alveolar crests near the lower anteriors.

The tissue adjacent to the lower anterior teeth was removed surgically, care being taken to cut on a bias, avoiding a gingival ledge.



1. The fibrous type of hypertrophic gingivitis. Such conditions require a surgical technic, care being taken not to establish a gingival ledge.



2. An x-ray film showing intact alveolar crests. At this early stage the bone is not involved.

No small amount of credit was given to the patient for the excellent result (fig. 3), contributed by "home care" of cleanliness and massage.

Case 2.—An air-combat crewman was observed as a mouth breather during sick call. He had no dental complaint. The examining medical officer demonstrated a complete nasal obstruction caused by a deviated septum.

Intra-oral examination revealed a well-formed lower arch in complete disharmony with a constricted maxilla (fig. 4). The mucosa in the front of



3. Five weeks later. Gingivectomy was needed only in the lower anterior region. Home care contributed greatly to this result.



4. A mouth-breathing gingivitis of the vascular type. No treatment other than vigorous toothbrush massage was necessary.

the mouth exposed to the air was hypertrophied, edematous, bluish-red in color, and very prone to bleed.

The pathologic report was the same as Case 1: "Chronic, nonspecific, exudative inflammation."

The x-ray examination revealed no alveolar absorption.

No other method of treatment was resorted to other than home care and there was no tartar formation. Especially emphasized was the toothbrush regimen in which a pumping action by the edge of the bristles was obtained. This forced stagnant blood into circulation and aided in the keratinization of the epithelium.

When the patient was seen 4 weeks later, the mucosa was normal.

COMMENT

For purposes of treatment patients who were considered mouth breathers but who had clear nasal passages were separated from those in whom the nasal passage was obstructed. In the former, various mechanical devices were employed to close the mouth while asleep. Adhesive tape proved the most effective, but the prospect of wearing this or any other cumbersome device to bed for the rest of one's life proved most discouraging. When periodontal treatment coupled with home care produced a cure, all other practices were discontinued.

No attempt was made to differentiate this pathologic condition from similar ones; the obvious fact of mouth breathing producing a hypertrophic gingivitis in the path of the inhaled air made the diagnosis simple. It must be mentioned, however, that many local and systemic disturbances cause the same condition.

A deep overbite was a contributing factor in the production of the fibrous type of hypertrophic gingivitis.



BACTERIAL EFFECT OF ALCOHOL ON THE SKIN

Since the normal skin is more or less moist, 100-percent alcohol is commonly effective against bacteria—at least on moister skins and under tropical conditions—while 60 percent to 65 percent alcohol may not be as efficient. The washing of the skin before the application exerts a similar effect unless subsequent drying is thorough. The value of a low surface tension may well be important in increasing spread and penetration for skin sterilization. As a general recommendation under all climatic conditions, 80 percent of alcohol by volume is probably most suitable for skin sterilization, though this will not be more effective than any other nonpersistent agent for dealing with deep-lying resident flora.—ARCHER, G. T. L.: Bactericidal effect of mixtures of ethyl alcohol and water. *Brit. M. J.* 2: 148-151, August 4, 1945.

FRACTURE OF THE ZYGOMA

REPORT OF A CASE

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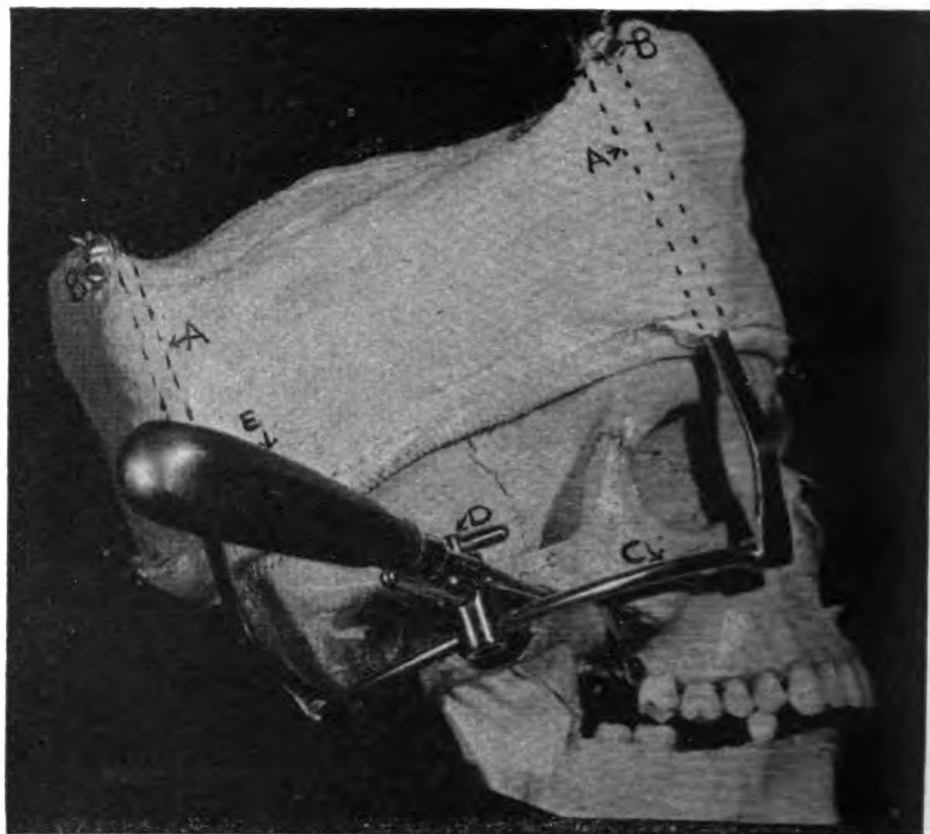
There are five possible avenues of approach to reduce fractures of the zygoma, namely, the direct facial, the temporal, the nasal, the intra-oral, and the antral route.

The direct facial route as described by New¹ has been the author's method of choice. This method employs a hook passed below the fragment through a small incision in the skin.



1. The extra-oral appliance in position showing its application in reduction and fixation of a laterally displaced right condyle.

¹ NEW, G. B.: Fractures of nasal and malar bones. S. Clin. North America 15: 1241-1250, October 1935.

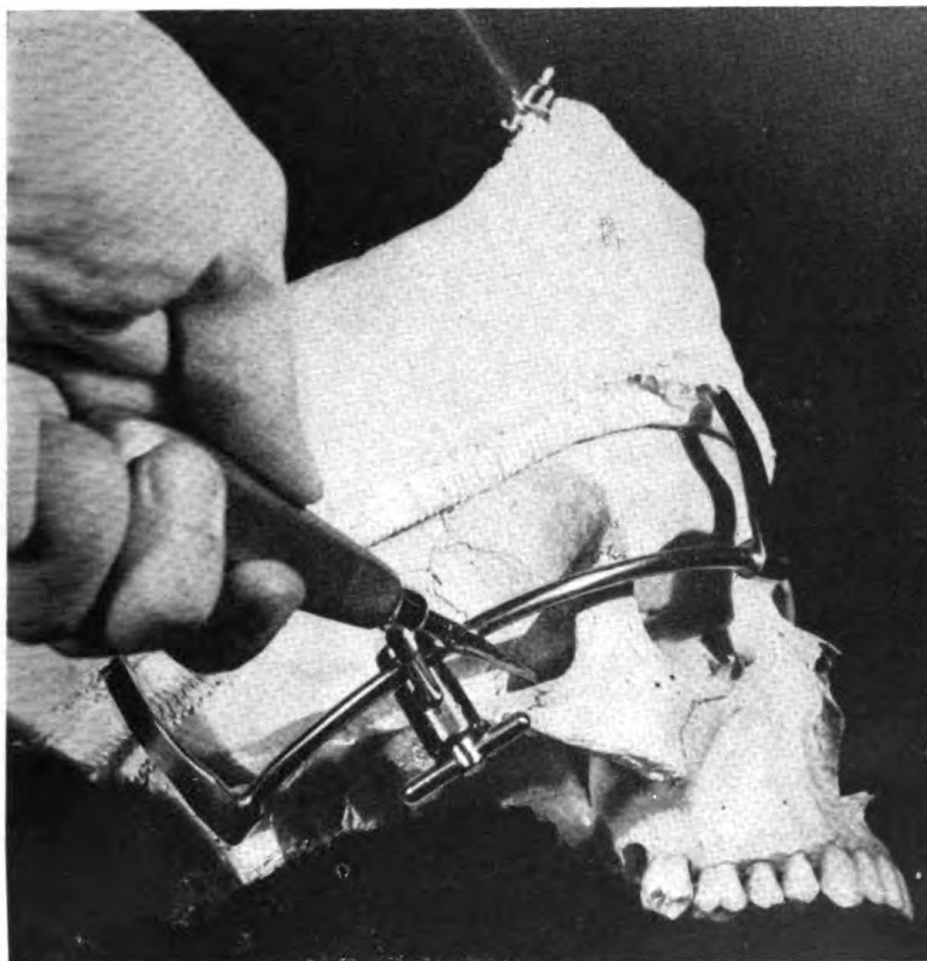


2. (A) Vertical bars in tracks made by wrapping loose gauze around bars before they are incorporated in the plaster head cap.
- (B) Lock nuts to permit upward and downward adjustment of vertical bars, thereby permitting horizontal bar (C) to be locked above or below zygomatic arch.
- (D) Sliding lock joint can be moved to any position along horizontal bar and is used as additional support for elevating instrument (E). This is the position used to elevate a depressed zygoma.

Fractures of the zygoma should be reduced as soon as the condition of the patient will permit. Up to 5 days most fractures of the zygoma can be reduced with comparative ease. Between 6 and 12 days it will be found that more force will be required. In such cases it has been found helpful to use the extra-oral appliance as a fulcrum to secure adequate controlled force properly to reduce the fragments. The use of the extra-oral appliance as an adjunct was discovered while reducing a zygomatic fracture 17 days following the injury.

Case report.—The patient had been injured aboard ship and was sent to this hospital on reaching port. A plaster head cap was placed (fig. 1), incorporating the extra-oral appliance described by Yando and Taylor.² The

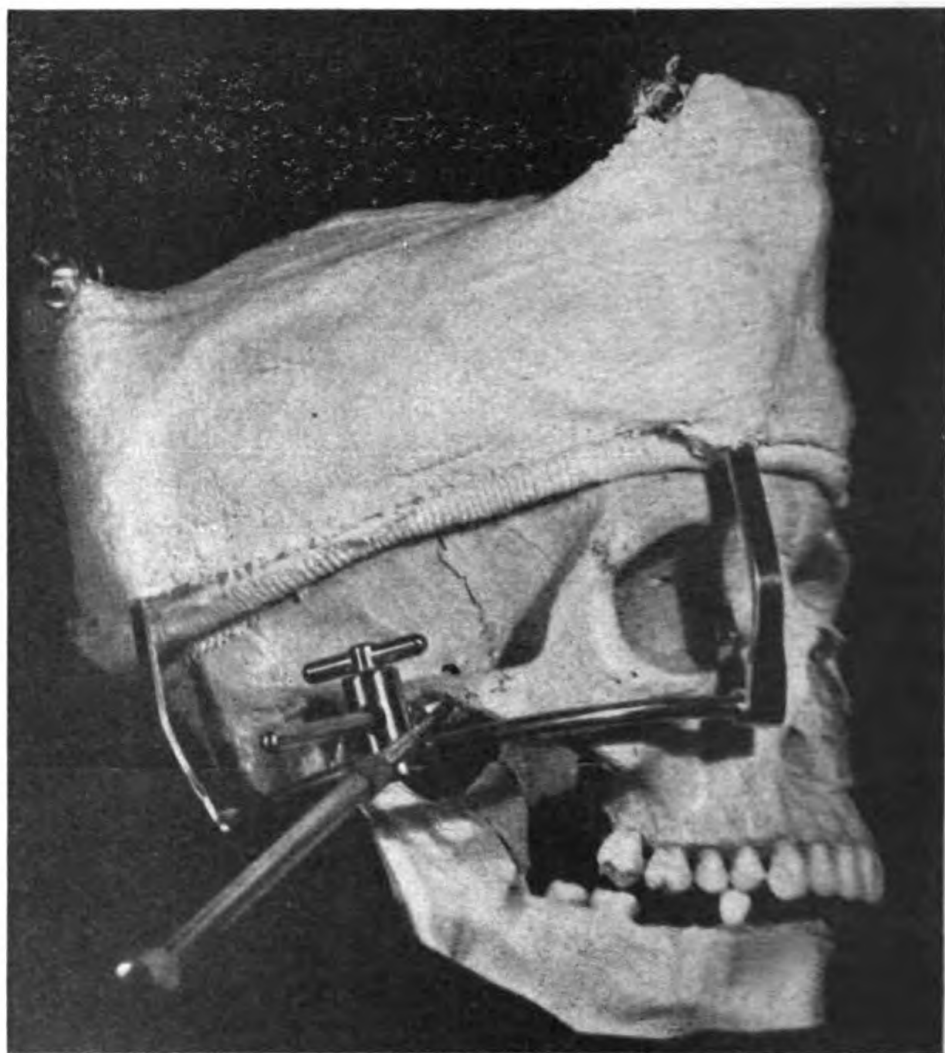
² YANDO, A. H., and TAYLOR, R. W.: Fractures of maxillae and mandible; 2 case reports. U. S. Nav. M. Bull. 40: 155-157, January 1942.



3. Horizontal bar above arch, lock joint turned down, and direction of force downward. Light pressure on the elevating instrument will create tremendous force due to the position of the fulcrum. Caution must be observed in applying leverage.

appliance consists of a horizontal bar embodying the principles of the Snow facebow. To this bar are attached two vertical bars which pass upward on either side of the face to contact bars embedded in a plaster head cap. These vertical bars are attached to the horizontally embedded bars of the cap by adjustable lock nuts, thereby allowing vertical movements of the appliance. Instead of using this appliance for a fractured maxilla, it was placed on the side of the head (fig. 1) to reduce a posteriorly displaced condyle by means of a pressure pad attached to the sliding lock joint.

When attempting reduction of the fractured zygoma and zygomatic arch, it was discovered that the plaster head cap could not be removed without cutting, so it was decided to sterilize the horizontal bar and proceed with the reduction. Local anesthesia was used. A small incision was made in the area of the zygomatic arch and the tissues were divided by blunt dissection with a mosquito forceps. Upon engaging the fractured bone with an elevator, the horizontal bar, together with the sliding lock joint, was found to provide an excellent fulcrum. The amount of force possible with this means



4. By removing the sliding weight from a crown-and-bridge remover, the hook can be used to pull the depressed zygomatic arch outward.

of leverage against the fractured bone was practically unlimited. The control of the direction of force was excellent.

A variety of dental instruments can be used with this method of reducing fractures of the zygoma. Application of these instruments in conjunction with the head cap and appliance is shown in figures 2, 3, and 4.

The method described has proved to be of definite value in the reduction of most fractures of the zygoma.

LARGE INFECTED RADICULAR CYST OF MANDIBLE

REPORT OF A CASE

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and

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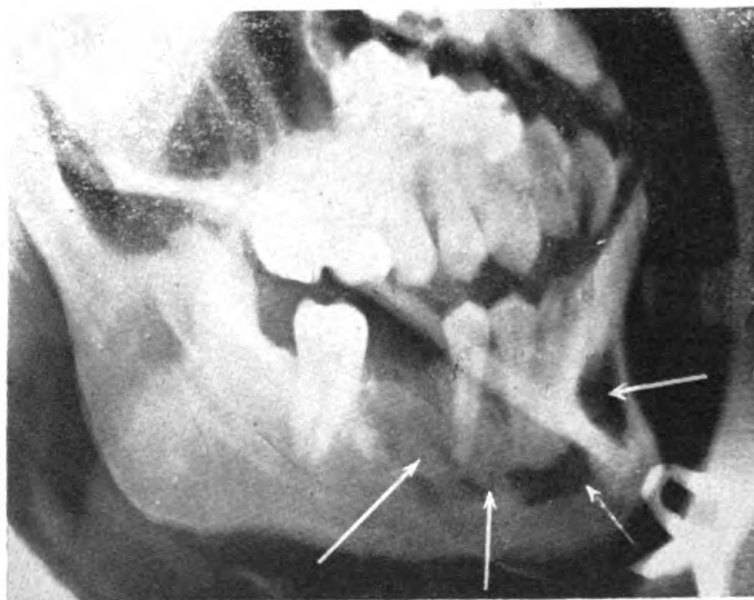
It is unusual for pain and disability to follow removal of a mandibular cyst. In the case reported here a large cyst was discovered at the time of removal of the right lower first molar and partial exposure of the cystic area. This procedure was followed by severe pain, local swelling and parotitis on the affected side.

Case report.—At the time the patient was first seen, at another dental activity, the teeth were not sensitive to percussion. There was swelling of the right cervical node, which was painful to palpation. Roentgenograms of the teeth revealed evidence of an abscess at the mesial root of the first molar and a large apical area (about 2 cm. by 1.5 cm.) of rarefied bone. Further roentgenographic examination showed an involved area which appeared to follow through part of the mandibular canal.

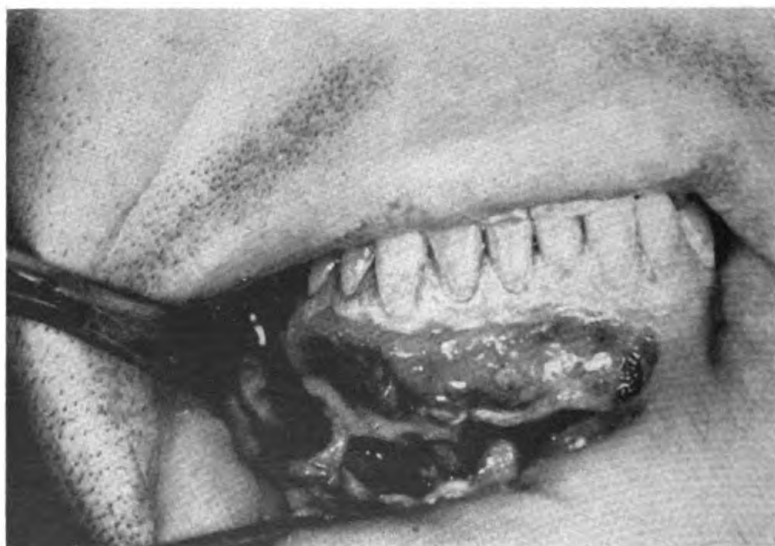
The first molar was removed. When curettement for granuloma was attempted, the instrument fell into a large eroded area. An incision was made from the area of the second molar to the first bicuspid. The bone was exposed and a window made in the external plate. Necrotic bone tissue was obtained. As curettement proceeded, more pockets were encountered until the symphysis was reached. Probing revealed that the process continued beyond the symphysis.

An iodoform pack, placed after curettage, was removed and a light pressure bandage was applied externally. Some slight oozing occurred. Three days later the external dressing was removed. Bleeding had stopped. The lip was swollen but the condition of the mouth seemed to be satisfactory. An icebag was applied to the lip and to the right side of the neck. Extra- and intra-oral roentgenograms revealed an area of bone loss from the mandibular first molar anteriorly and past the midline to the mandibular left cuspid.

Six weeks later the patient was referred to this activity. Oral examination showed a long irregular wound extending from the right mandibular first molar socket anteriorly to the midline. The soft tissues were superficially necrotic and a slight amount of thin blood and purulent material was draining from the lesion. There was swelling and some pain. The patient also had general malaise, a sore throat and a headache. The temperature was 100° Fahrenheit. The leukocyte count was 21,850, with 8 percent band forms, 66 percent segmented cells, 24 percent lymphocytes, and 2 percent monocytes. There was slight swelling under the right ear, and swelling over



1. The radiolucent area extended from the first molar region to the midline of the mandible.



2. An incision was made and the flap reflected.

the region of the right parotid gland. The throat was moderately inflamed. There were no other pertinent physical findings.

Intra- and extra-oral roentgenograms revealed a radiolucent area which followed the course of the mandibular canal forward but which continued and passed the midline to reach the left lateral incisor region.

An incision was made over this area, a flap reflected, and the entire area exposed (fig. 2). The overlying bone was removed, the unhealthy granulation tissue was curetted (fig. 3), and penicillin powder in sulfanilamide and a gauze drain were placed in the wound (fig. 4). Three days later culture of the specimen showed an overgrowth of *Proteus vulgaris*. Suppuration had ceased, the swelling was lessened and the general condition improved. Six days after operation the swelling had decreased greatly and improvement continued.

3. The overlying bone and the unhealthy granulation tissue were removed.



4. Penicillin and sulfanilamide powder were placed in the wound.



The specimen removed consisted of fine fragments of ragged tissue, some of which was covered by epithelium. Microscopic examination showed a few spicules of osseous debris, vascular connective tissue, and an infiltration of leukocytes. There was a cystic membrane with a fibrous wall lined internally by a thick layer of stratified squamous epithelium. This epithelium showed acanthosis and spongiosis, and at several points was infiltrated by inflammatory cells. The pathologic diagnosis was cyst with ossifying membrane.

The cavitation steadily decreased in size, with healthy granulation tissue. Pain and tenderness disappeared, and the patient was discharged to duty. Routine mouth hygiene should keep the wound clean until it is completely closed.

COMMENT

The cystic area which extended from the mandibular first molar anteriorly and past the midline, probably had its origin in the

diseased periapical tissues of the first molar. The unusual amount of pain and subsequent disability experienced by the patient is rare in mandibular cysts. A probable explanation is that the entire area became acutely infected following tooth extraction and then acted as a large acute abscess.

A liberal incision exposed the entire area and permitted thorough curettage and removal of the diseased tissue. The use of penicillin in sulfanilamide powder covered with gauze made a satisfactory postoperative dressing which protected tender exposed structures and yet held the soft tissue margins apart to permit healing from within outward.



PENICILLIN EFFECT ON INTESTINAL BACTERIA

Changes in cultural characters and bizarre involution forms are produced by the gram-negative intestinal bacteria growing in liquid and solid media containing inhibitory, but not completely bacteriostatic concentrations of penicillin.—THOMAS, A. R., JR., and LEVINE, M.: Some effects of penicillin on intestinal bacteria. *J. Bact.* 49: 623-627, June 1945.



MARCH HEMOGLOBINURIA

Hemoglobinuria repeatedly developed after two infantrymen had marched, respectively, approximately 3 and 5 miles. The diagnosis was made by the repeated finding of hemoglobin in solution in the urine after marches. The presence of hemoglobinuria was confirmed spectroscopically.—LINDHAI, W. W., and FATTER, M. E.: March hemoglobinuria; report of two cases. *J. Urol.* 53: 805-807, June 1945.



IMMUNIZATION AGAINST MALARIA

When ducks are injected with formalin-inactivated *Plasmodium lophurae* in combination with a lanolin-like substance, paraffin oil and killed tubercle bacilli, they develop considerable resistance to subsequent infection with *Plasmodium lophurae*.—FREUND, J.; SOMMER, H. E.; and WALTER, A. W.: Immunization against malaria; vaccination of ducks with killed parasites incorporated with adjuvants. *Science* 102: 200-202, August 24, 1945.

CASE OF KERATODERMIA BLENNORRHAGICUM (GONORRHEAL DERMATITIS)

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The rarity of keratoderma blennorrhagicum (gonorrheal dermatitis) as a skin disease and a complication of gonorrhea is believed to warrant the presentation of the following case which was observed and treated aboard a carrier in the Pacific. An adequate description of this condition is lacking in several leading textbooks on venereal diseases, dermatology, and medicine. This condition might be termed a nonvenereal manifestation of a venereal disease.

Case report.—A fireman, second class, 21 years of age, reported to the sickbay complaining of itching of the hands and feet, pain in both knees, backache, and fever of 3 days' duration. He also complained of a slight watery urethral discharge. He admitted having sexual intercourse with a "pick-up" and that he had been drinking rather heavily at the time of exposure. The onset of his illness occurred 4 days after exposure. His past medical and family histories were irrelevant.

Physical examination showed the patient to be a very well-developed and well-nourished young man in obvious discomfort because of intense pruritus, and painful back and knees. At the time of admission his temperature was subnormal, pulse rate 68, and respirations 20 per minute. Three hours after admission his temperature was 99° F.; 6 hours later it was 101° F., and the pulse rate was 90 beats per minute.

On the skin of the plantar surface of both feet and the dorsal aspect of both hands, there were observed skin lesions in various stages of eruption. Vesicles, pustules, and incrustated lesions predominated. On the plantar surface of both feet there were a few small areas, irregular in shape, about the size of a nickel, which were raw and ugly appearing. This type of lesion was not present on the hands. There was moderate edema of both hands and feet. Articular pain was experienced by the patient on passive and active motion of the knees or the back. Palpation of the musculature in the lumbar region elicited moderate tenderness. A light purulent urethral discharge was present.

A low-grade fever (101° F.) persisted during the first 2 days of hospitalization, and the skin lesions persisted. After rupture of the vesicles and pustules on the plantar surface of both feet, the crusts coalesced, forming large, horny, crusted areas which became dry and could be easily peeled. The lesions were more extensive on the right than on the left foot. This condition is often referred to as pseudokeratinization. These lesions never developed or spread above the ankles or wrists and generally remained symmetric.



1. Photograph of the hands on the seventh day of the disease. Very few vesicles are seen. Note incrustation near the tips of the fingers. The black areas are where vesicles were painted with 10-percent silver nitrate.

—Official U. S. Navy Photo.

The leukocyte count was 10,500, with a differential of 78 percent polymorphonuclear leukocytes, 20 percent lymphocytes, and 2 percent monocytes. Urinalysis yielded negative findings. Smears from urethral discharge showed a few pus cells but no organisms. A Kahn blood test was negative.

The patient presented a diagnostic problem at this time, and because of the bizarre nature and distribution of the skin lesions, it was decided to aspirate the contents of the vesicles and pustules. Smears and slides were made and stained by the Gram method. Microscopic examination revealed numerous polymorphonuclear leukocytes, lymphocytes, and a few plasma cells. Intracellular and extracellular gonococci were also present. These smears were repeated twelve times from different lesions and all revealed the above-mentioned cellular elements and organisms.

The appearance of gonococci established the nature of the disease, and sulfathiazole, 1 gm. every 4 hours, was administered orally for 3 days. The patient's temperature and pulse receded to normal, no new lesions appeared, the pruritus subsided, and in general he felt comfortable. The skin on the plantar surface of both feet became dry, incrustated and could be very easily peeled off, resembling keratosis. Silver nitrate, 10-percent, was applied locally to these cornified areas and the few remaining crusts on the hands. Progress from the fifth day of admission to the time of discharge (eighth day) was uneventful. The skin of the plantar surface of the feet showed hyperpigmentation for 3 weeks following discharge; no new lesions appeared.

This patient presented a classic clinical picture of keratoderma blenorrhagicum characterized by articular pains, headache, fever,



2. Peeling of the skin of the plantar surface of the right foot ("relief map"). Vesicles, pustules, and incrustation on the plantar surface of the first three toes (left foot). Keratoses on the plantar surface of the left foot. Photograph taken on the seventh day of the disease.

—Official U. S. Navy Photo.

slight urethral discharge, and symmetric bilateral eruptions on the skin of the hands and feet, the lesions developing into vesicles and pustules with incrustation and pseudokeratinization. A history of sexual intercourse, leukocytosis (10,500), a temperature of 101° F., and the recovery of gonococci from skin lesions aided materially in establishing the diagnosis.

The type and location of the skin lesions in this case coincide with those described in 1920 by McDonagh, who observed 21 cases on the continent during World War I. Williams¹ in recent years made a thorough search of the literature and could find only 15 cases recorded. However in only two of his own cases were gonococci recovered from skin lesions.

¹ WILLIAMS, A. W.: Keratoderma blennorrhagicum. Brit. M. J. 2: 627-629, October 10, 1914.

Many theories have been established regarding the nature and pathology of the disease. Pelouze speaks of it as trophic in origin and claims that it is impossible to recover the gonococci from the skin lesions. Other authorities are of the opinion that a gonococcal bacteriemia (gonococcemia) is responsible for the skin lesions. In the case reported here it is believed the latter theory applies, in that the causative organism was the gonococcus, which by-passed a highly resistant urethral mucous membrane and became blood-borne, resulting in a gonococcemia and gonotoxemia causing a local nonvenereal manifestation of a venereal disease.

The interesting features of this case were: (1) The typical history and classic symptoms of the disease with mild urogenital involvement of 2 days' duration, occurring 3 days after sexual intercourse; (2) the presence of gonococci in the skin lesions (for positive bacteriologic confirmation an attempt was made to contact the source of infection without success, and culture of the organism was impossible due to the lack of adequate laboratory facilities aboard ship); and (3) the clinical response and cure of the condition by internal administration of sulfathiazole and application of 10-percent silver nitrate to the local skin lesions.



CENTER OF GRAVITY IN MAN

Whatever the pathologic or physiologic state (e.g., pregnancy), the center of gravity of the body lies within a sphere 7 percent of the body length in diameter. In health (presumably excluding pregnancy) the diameter of the sphere is reduced to 2 percent of the body length. Respiratory and cardiac movements cause oscillations of the center of gravity within these limits.—DAMIR, A. M.: Location of center of gravity in man. *Brit. Abstracts, A III*; physiology, biochemistry, anatomy. p. 373, June 1945.



PROCAINE BLOCK IN HERPES ZOSTER

Herpes zoster has been treated by infiltration of the appropriate sympathetic ganglions with procaine hydrochloride. In each of 4 instances, relief from pain was instantaneous and permanent and the lesions healed rapidly. Regional sympathetic block relieves herpetic pain by abolishing segmental vasospasm. The technic of infiltrating the cervicodorsal and second and third thoracic sympathetic ganglions by the anterior approach is not difficult.—FINDLEY, T., and PATZER, R.: Treatment of herpes zoster by paravertebral procaine block. *J.A.M.A.* 128: 1217-1219, August 25, 1945.

PYLETHROMBOPHLEBITIS AND HEPATITIS FOLLOWING APPENDECTOMY

REPORT OF A CASE WITH RECOVERY

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and
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One of the most dreaded complications of acute suppurative appendicitis is the sequence of portal thrombophlebitis, hepatitis, and multiple pyogenic hepatic abscesses.

According to Ochsner and DeBakey, the most frequent antecedent lesion in cases of pyogenic abscess of the liver is suppurative appendicitis. This complication is not common, occurring in 0.36 percent of their 68,198 collected cases of acute appendicitis. Eleven percent of their series of 47 hepatic abscess cases were traced to acute appendicitis.

Pyogenic abscess of the liver, unlike that of amebic origin, is usually multiple. Undoubtedly inflammation occurs throughout the liver before scattered areas break down and suppurate. This is more pronounced in the right lobe, where blood from the cecum and ascending colon accumulates because it enters the portal stream on that side.

A chill occurring during an attack of appendicitis, or postoperatively, should demand immediate consideration of pylephlebitis or pylethrombophlebitis. Fever, pain and tenderness occur in approximately 90 percent of liver abscess cases. The fever is of a remittent type, the pain is in the upper part of the abdomen, particularly on the right side, and tenderness is extreme along the costal margin anteriorly. Nausea and vomiting, loss of weight, and jaundice occur, but only, according to Ochsner and DeBakey, in one-third of the cases.

Diagnosis is established by a septic type of fever and chills, following the occurrence of some suppurative lesion in a region drained by the portal system. Elevation of the right diaphragm as shown by roentgenographic examination is substantiating. The leukocyte count is elevated. These patients are usually extremely ill.

The prognosis of multiple pyogenic hepatic abscess is grave, the mortality being 70 percent. Drainage is difficult, yet those patients who are not operated upon usually die. Transpleural or transperitoneal procedures for drainage resulted in a 71-percent mortality in Ochsner and DeBakey's series, while extraperitoneal drainage gave a mortality of 33 percent.

The treatment advocated, once suppuration has occurred, is extraperitoneal drainage. In cases with associated pylephlebitis, ligation of the involved tributaries of the portal vein, or the vein itself has been advocated by Wilms. However drainage of multiple abscesses is usually of little avail.

Complications of multiple pyogenic abscesses of the liver include rupture of an abscess into the peritoneal or pleural cavities. One of us (S. D. M.) has seen a particularly rare sequela, namely, esophageal varices resulting from cicatricial embarrassment of the portal circulation following recovery from postappendiceal pyogenic hepatic abscess. This was verified by operation, at which time the coronary vein of the stomach was ligated to control severe hematemesis.

The following case is that of a patient who developed pylethrombophlebitis and hepatitis 12 days following the removal of an acutely inflamed appendix. Recovery without abscess formation followed chemotherapy.

Case report.—The patient, a well-developed, adequately nourished white male, 19 years of age, was admitted with the complaint of abdominal pain which had begun in the epigastrium approximately 12 hours previously, and was intermittent in character. He became nauseated, and vomited four times. Later the pain became steady in character, and was felt more in the right lower quadrant of the abdomen. There were no abnormalities related to urinary function, and he had had one normal bowel movement subsequent to the onset of the pain. The previous evening he had eaten dinner, gone to bed shortly thereafter, and enjoyed a good night of sleep. He awoke with the pain present, and presented himself for treatment within 4 or 5 hours when it failed to subside. There was no history of previous attacks.

Upon examination the outstanding finding was generalized abdominal tenderness. Acute pain was elicited by pressure over McBurney's point. When pressure made on the left side was released, there was rebound pain on the opposite side. No abdominal masses were palpated, and rigidity was minimal. Digital examination of the rectum revealed nothing significant. The pharynx and lungs were found to be normal. Abdominal respiratory excursions appeared restricted. The temperature was 99.6° F., the pulse rate 98, and respirations 22 per minute. The leukocyte count was 9,900, with differential count within normal limits. Nothing of interest was found on urinalysis.

The diagnosis of acute appendicitis was made, and the patient prepared for immediate appendectomy. Using analgesia produced by the intrathecal introduction of 150 milligrams of procaine, the abdomen was opened by a modified transverse Rockey-Davis incision. This type of incision has the distinct advantage of producing adequate exposure of the cecal area. Fur-

thermore division of the external oblique fascia, to a great extent, and of the internal oblique and transversalis fascia and peritoneum, is made in the direction of component fibers, affording a more substantial closure.

As the peritoneum was divided, approximately 8 cc. of thick purulent fluid was found pocketed over the cecum; this was aspirated.

The appendix was found to be in a retrocecal position, measuring approximately 10 cm. by 0.8 cm., with the width of the distal third increased to 1.5 cm. as a definite bulb. The bulbous portion was lusterless and of a purplish-black hue. Serosal vessels of the proximal part showed definite congestion. No serosal exudate was found upon gross examination.

In view of the retrocecal position of the appendix, it was considered advisable to remove the viscus in a retrograde manner. Four Ochsner forceps were placed adjacent to each other at the base of the appendix, and amputation was done between the middle two. The cut areas were treated with phenol, followed by alcohol, and then touched with a dry sponge. A purse-string suture of quilting cotton was made to encircle the base of the appendix, care being taken to form an extra loop at the mesenteric border. This was to forestall bleeding from an intramural branch of the appendicular artery in the event that this artery existed. This vessel occurs in approximately 20 percent of cases, and must be assumed to be present as it cannot be seen at operation.

The distal Ochsner forceps was removed from the stump of the appendix, and the projecting tip grasped with smooth tissue forceps. With the stump fully under control, the proximal Ochsner forceps was removed, and the unligated stump of the appendix inverted into the cecum. The purse-string suture was drawn tight and tied. Two Lembert sutures of quilting cotton were taken over the site of inversion.

At this point the spinal analgesia was supplemented with ether anesthesia by the open-drop method. The appendix was then removed after vessels in the mesenterium were individually clamped, divided, and ligated with quilting cotton, and the abdomen was closed in layers, interrupted sutures of quilting cotton being used throughout.

A rubber-dam drain was introduced through the lateral extremity of the skin incision and carried down to, but not through, the peritoneum. This was done to prevent the accumulation of pus in the form of an abdominal wall abscess.

Postoperatively, the patient was treated for peritonitis, for it was realized that the localized condition seen at operation could easily have become generalized by the intra-abdominal manipulations.

After the patient had been supine for 8 hours following spinal puncture, he was placed in Fowler's position. A heat tent was used over the abdomen to produce integumentary vasodilatation.

Morphine in full therapeutic dosage was given every 4 hours for its tonic effect on the smooth muscle of the small intestine, and, as a routine measure, the patient hyperventilated the lungs at frequent intervals, and pushed the feet against the foot of the bed.

During the first 24 hours following operation, nothing was allowed by mouth, fluids being provided parenterally. Urination occurred voluntarily 8 hours postoperatively. The abdomen remained soft, and nausea did not supervene; however the patient's temperature rose to 103° F. 12 hours following operation, and then subsided to a range between 101° and 101.8° Fahrenheit. Parenteral fluids were continued. Sips of water were allowed by mouth, to be discontinued if nausea was experienced. The wound was

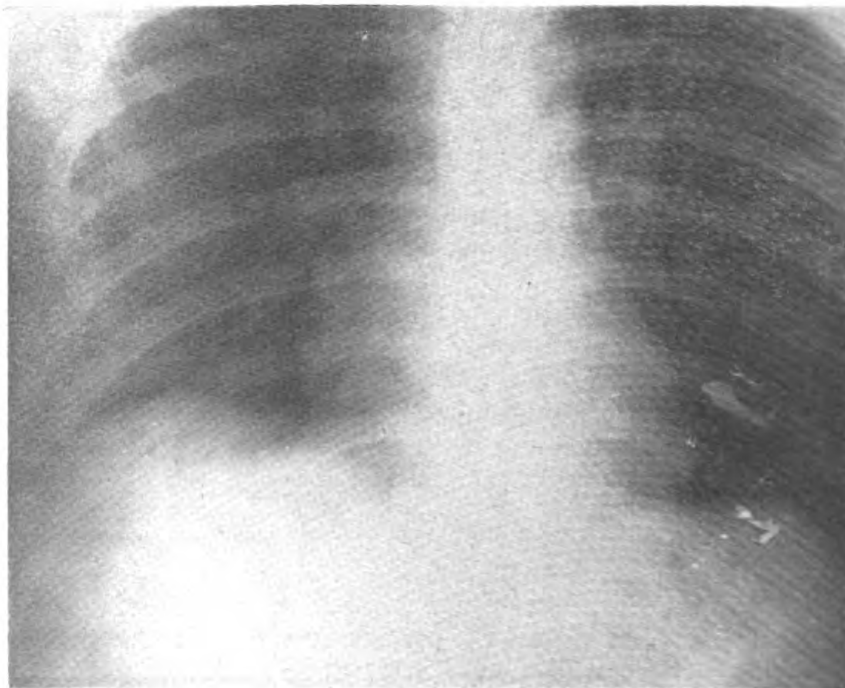
inspected, and a small amount of serous drainage was present along the rubber-dam tissue. No noticeable induration or swelling was seen. There were no tender points noted.

A liquid diet consisting of fat-free broth and clear, unsweetened tea was instituted on the second postoperative day. Milk, ice cream, fruit juices and carbonated beverages were not allowed until the patient tolerated a full diet. The temperature range on the second day was between 100° and 100.6° Fahrenheit. The rubber-dam drain was removed from the incision at this time.

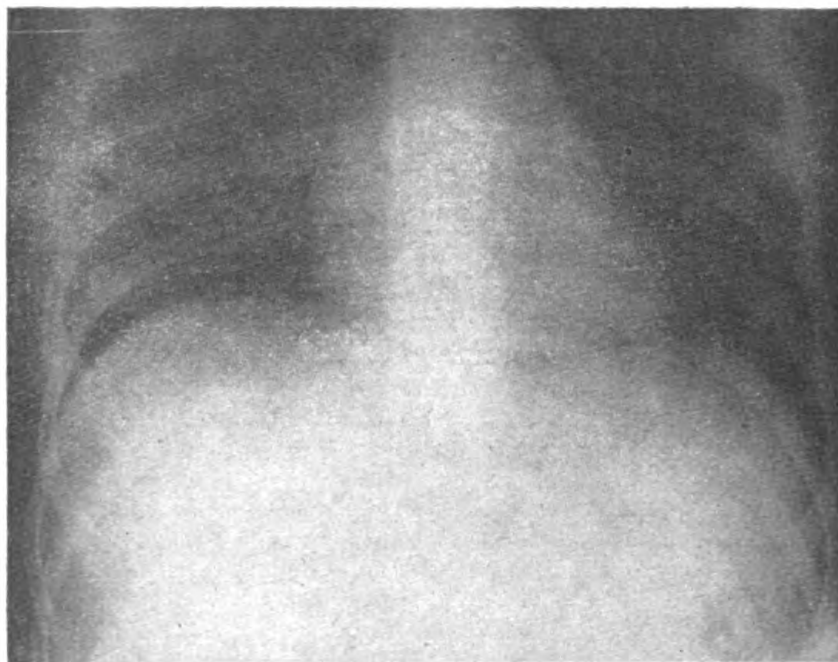
On the third postoperative day, the patient's temperature reached normal in the morning but rose to 99.8° F. in the evening. This type of curve continued for the next 8 days. The wound continued to discharge a scanty amount of serous fluid at the site of the drain, but this did not seem sufficient to explain the febrile state. No tenderness was found by palpation over the lower part of the abdomen, by rectal palpation, or by pressure over the twelfth rib posteriorly. Auscultation of the thorax revealed normal breath sounds.

A soft diet was given on the sixth postoperative day, and at this time the skin sutures were removed. Unrestricted feeding started the following morning, and the patient was allowed to be up and about.

After being permitted to put on his clothes and walk around for 5 days, but still with a daily rise of temperature from about 98.6° to 99° F., the patient suddenly complained of feeling bad on the twelfth postoperative day, and his temperature was 101° Fahrenheit. Although he could not definitely



1. Roentgenogram taken 24 hours after onset of chills. At this time the liver was enlarged to 3 cm. below the right costal margin and was extremely tender. Note that the right diaphragm extends two intercostal spaces higher than that of the opposite side. Although the central part of the right diaphragm is abruptly elevated, the contour is regular. The costophrenic and cardiophrenic angles are unaltered.



2. Roentgenogram taken 4 days after recovery. Shadows of the right and left side of the diaphragm overlie corresponding ribs in the postero-anterior view. There is considerably less distortion of the right side of the diaphragm.

describe his pain, he best expressed it as an aching and soreness in the pit of the stomach and on the right side under the ribs. No pain was experienced in the shoulder or back.

On the night of the twelfth postoperative day, the patient experienced a chill, and complained of increasing soreness in the pit of his stomach. A slight degree of rigidity was present in the epigastrium. The temperature was 101.8° Fahrenheit. The chills which followed were hard and shaking, and though the room temperature remained above 90° F., the patient preferred to keep covered with blankets. Palpation along the edge of the liver elicited pain, and the liver was felt to be enlarged, extending approximately 3 cm. below the costal margin. Roentgenograms revealed evidence of great enlargement (figs. 1 to 4). Cardiophrenic and costophrenic angles were unaltered. Urinalysis did not disclose any abnormality. The leukocyte count was 14,000, and the differential cell count was still within normal limits.

A diagnosis of postappendiceal pylephlebitis and hepatitis was made and treatment instituted. Sulfathiazole, grains 30, was given initially, followed by grains 15 every 4 hours. Abundant fluids were given and daily urinalyses done. Infusions of 5 percent dextrose and one unit of plasma were administered. Sweetened fresh orange juice was given at frequent intervals.

The following day the patient remained acutely ill, the oral temperature rising to 103° Fahrenheit. The abdominal muscles were rigid above the umbilicus, and the hepatic area was quite tender. Pressure over the twelfth rib posteriorly, however, was not painful.

The following day the patient appeared improved. He seemed much more responsive mentally. The temperature ranged between 100° and 101° Fahrenheit. On the third day following the chill, his morning temperature was

normal, but rose to 99° F. in the evening. He felt hungry and in general, quite well. The abdomen was soft, with only a slight residual tenderness over the liver. There was no jaundice at any time.

All sulfathiazole was discontinued on the next day. There was rapid improvement, the temperature remaining normal, and the patient was discharged to duty 21 days after admission. A check-up 10 days later showed the wound to be well healed, and the patient doing his usual work with no complaints.

A septic type of fever, chills, upper abdominal pain, liver enlargement with extreme tenderness, leukocytosis and a general appearance of acute illness following recovery from acute appendicitis point to the diagnosis of portal thrombophlebitis and hepatitis. If this process is unchecked, multiple pyogenic abscesses of the liver will surely result. Failure of the infection to progress to suppuration following chemotherapy is considered significant. Apparently the process can be checked, even after pylethrombophlebitis and hepatitis have occurred.



HEPARIN FOR FROST BITE

Experimental frost bite was induced in human subjects by applying to the skin the bottom of small porcelain crucibles filled with dry ice. The controls developed necrosis of the exposed area while the adequately heparinized subjects, apart from superficial blistering of varying degree, escaped any deeper injury.—LOEWE, L.; LANGE, K.; and ROSENBLATT, P.: Heparin in treatment of experimental human frost bite. Bull. New York Acad. Med. 21: 442, August 1945.



MIXED ATOPIC AND INFECTIOUS ASTHMA

Mixed atopic and infectious asthma has definite evidences of both. It is important to determine, from the history, which came first. Infection complicating primary atopy is perhaps more amenable to atopic and conservative rhinologic management than is atopy added to infection. This large group requires the combined services of the allergist and the rhinologist. The problem is not how but when and what rhinologic procedures to follow.—EDITORIAL: Classification of asthma. J. Allergy 16: 199-200, July 1945.

MEDICAL AND SURGICAL DEVICES

UNIVERSAL VASCULAR COMPRESSOR FOR THE DEVELOPMENT OF COLLATERAL BLOOD CIRCULATION IN ARTERIAL AND ARTERIOVENOUS ANEURYSMS¹

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The number of injuries to blood vessels and the many arterial and arteriovenous aneurysms subsequent to such injuries have greatly increased as a result of the use of modern firearms. Spontaneous recovery from arterial and especially arteriovenous aneurysms is so rare that one must discount its occurrence. In most instances, therefore, resort to operation is the only indicated means of treatment.

To this day there are no definite trends in the time of surgical interference. While some surgeons regard the second and third week after injury as the most propitious, others prefer waiting even as long as 3 months.

Side by side with the advocates of complete momentary ligature with sympathectomy (Ratner), incomplete ligature (Halsted, Matas, Allen), the operation of Kikutsi-Sym (ligature inside the sac), and the operation of Matas (obliterated or reconstructive), one can meet supporters of the practice of vascular sutures for the preservation of the lumens of vessels.

However because of pathologic changes in the vessel walls, even the convinced supporters of vascular suture are often obliged to terminate the operation with the ligation of the vessel. In other words ligature of the blood vessel in its pure aspect accompanied by dissection of the sac is the preferred operation in the treatment of arterial and arteriovenous aneurysms to this day, just as it was in the time of Antyllus, Philagrius, or Anel.

This operation is technically very simple and always practicable, irrespective of any pathologico-anatomic changes in the vessel

¹ From the surgical clinic of the Naval Medical Academy, U.S.S.R.

wall. However it does have a number of negative points. First of all one must remember the possibility of necrosis of the limbs following upon the ligation of the main arterial trunk. The data of Senser (1916) during World War I show that this complication occurred in 10 percent of the cases of ligation of the large arterial trunks.

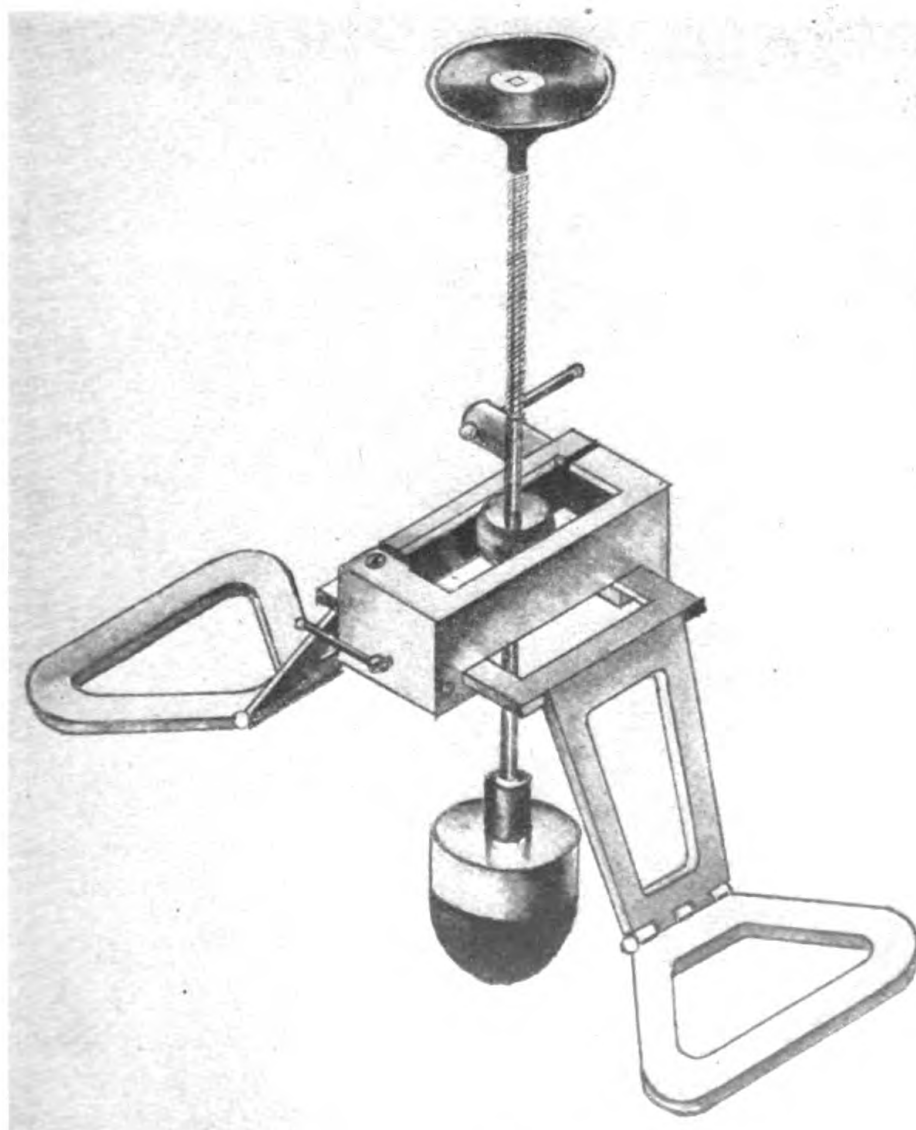
Ratner is quite right in saying that since the days of Jones, Hunter, and Desault, the surgeons of all countries have been working on the problem of preventing gangrene of the limbs after ligation of the arteries and thus lessening the number of amputations. Not all arteries are affected equally. Ligature of the popliteal artery is particularly hazardous in its end results. Nearly 20 percent of ligations of the carotid artery threaten the patient with a serious disorder of the blood circulation in the brain. The momentary ligature of these vessels is so dangerous that Halsted came to the conclusion that only incomplete ligatures could be applied. For prolonged ligatures Matas and Allen introduced special aluminum plates which are applied whenever a momentary ligature may threaten disorder of the blood circulation or necrosis such as may occur on ligation of the carotid, the subclavian, the iliac, and the popliteal arteries.

Whereas there are essential differences of opinion among surgeons regarding the best treatment of arterial and arteriovenous aneurysms, the necessity of a preliminary development of collateral circulation is beyond all question. Even Ratner, who believes that the sympathectomy which he performs at the time of ligature of the vessel is a guarantee against gangrene, cautiously observes: "However I have no right to assert that the operation of sympathectomic ligature finally solves the question of gangrene after the operation of aneurysms. The collateral blood circulation has not been sufficiently well studied to allow of such definite inferences. This circumstance forces us to combine the operation with other tried means, improving the collateral blood circulation. *Before the operation we prepare the collaterals by mechanical compression* (italics not in original), by contrast baths, and diathermy."

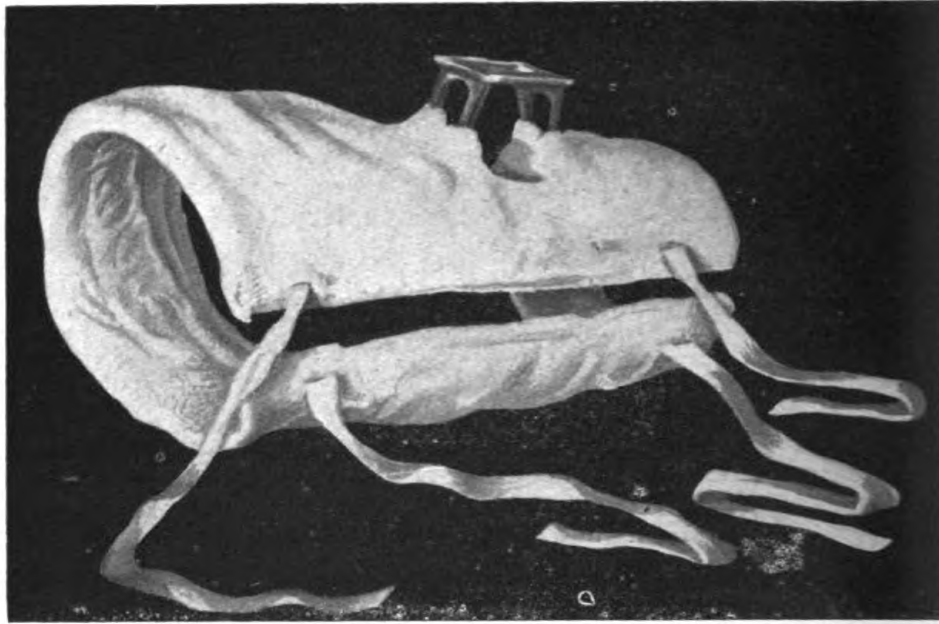
In most medical institutions compression of the arterial trunks is carried out by having the physician or the nurse press the vessel with a finger. But such compression soon tires the person who applies it. It therefore gradually becomes feebler until at last there remains only a semblance of pressure. But even supposing that finger pressure on the vessel is effective it is not practicable when there are several wounded in the ward suffering from aneurysms, because it then becomes necessary to occupy several

of the medical attendants with compression only. As a way out of this difficulty the compression is entrusted to the patient himself. As a rule, however, the patients do not make enough effort and the compression is merely imaginary.

In order to obviate these difficulties, a vessel compressor has been devised. Compression of the vessel is effected by a screw rod, fastened in a block at the required angle by a globular nut. The block moves along the grooves of the upper arm of the clamp. The hand wheel is removable, so that the patient cannot increase or decrease the pressure himself. After the required degree of compression has been established, the surgeon takes off the hand wheel and only fastens it back again just before the apparatus is removed from the patient.



1. Vessel compressor assembled.



2. Vessel compressor incorporated in plaster cast ready for use in compressing femoral artery below Poupart's ligament.

In order to use the apparatus it is necessary only to study its simple application, its assembling and disassembling; all very simple processes.

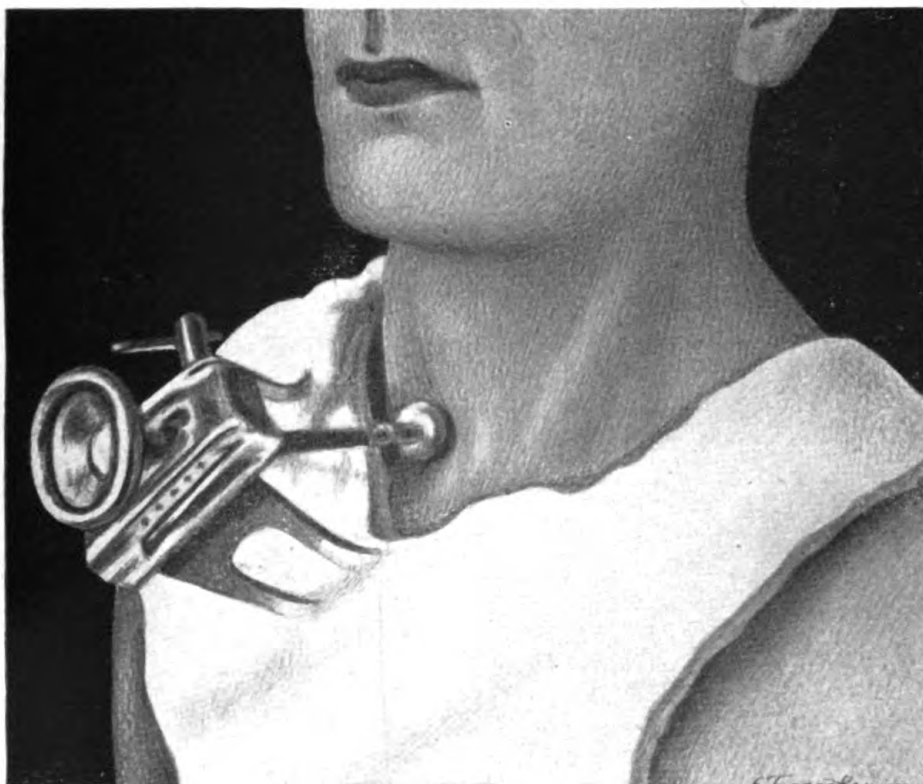
A constant or removable plaster bandage in which the clamp is fixed is applied to the patient (fig. 2). When the bandage has been put on and the clamp is firmly fixed in place, the process of compressing the vessel is begun.

Compression of the common carotid (fig. 3) is effected approximately on the level of the Chassaignac tubercle, between the ends of the sternocleidomastoid muscle. The patient is placed in a recumbent position, with his head slightly raised on a pillow.

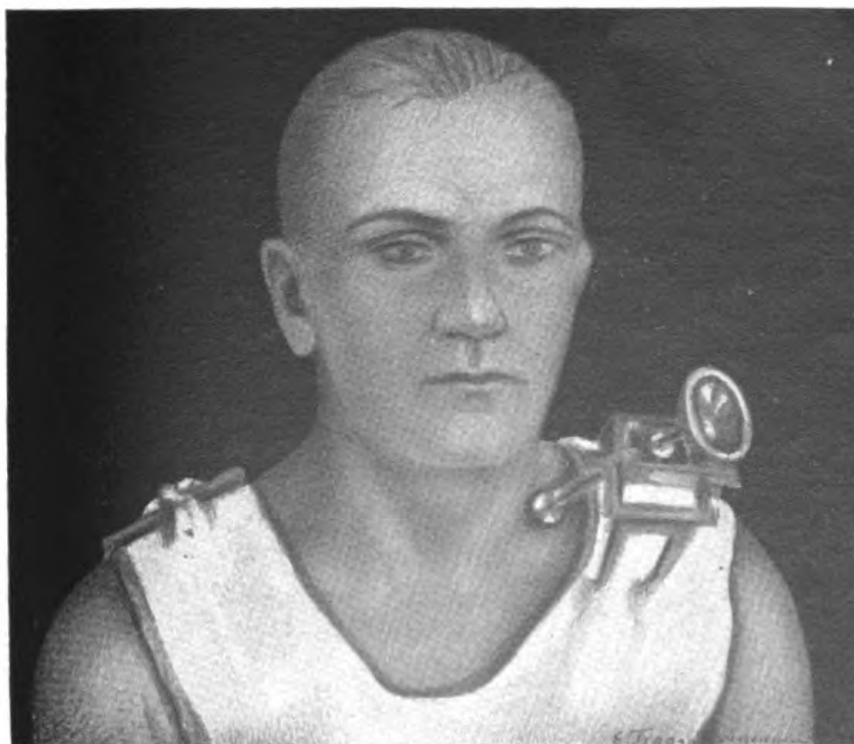
Compression of the subclavian artery (fig. 4) is effected between the clavicular part of the sternocleidomastoid muscle and the upper side of the clavicle. The position of the patient should be recumbent with head lightly elevated.

Compression of the femoral artery is effected under Poupart's ligament, above the transverse part of the pubis. The patient should be placed in a recumbent position.

At first the compression is applied several times a day for from 10 to 15 minutes each time, then, for the subclavian and femoral arteries, compression may be applied for 2 or 3 hours several times a day in the course of the next week. Regarding the common carotid, great caution must be practised at first, beginning the process of compression with only 1 or 2 minutes at a time. Careful watch must be kept to see that no symptoms indicating any dis-



3. Vessel compressor applied to right common carotid artery.



4. Vessel compressor applied to left subclavian artery.

order of the blood circulation in the brain appear, such as paresthesia or paralysis.

There is no way of foreseeing how any patient may react to compression of the common carotid. The following example is a striking illustration of the possibility of a dangerous reaction occurring.

Case report.—A 23-year-old man was wounded 25 July 1943 by a mine fragment. Two weeks later diagnosis established an arteriovenous aneurysm between the right common carotid and the internal jugular vein. On 2 September the patient was admitted to the surgical clinic of the Naval Medical Academy where the diagnosis was confirmed. Laryngologic examination likewise revealed paralysis of the recurrent laryngeal nerve as a result of the injury.

On 4 September the vessel compressor was applied in order to develop the collateral blood circulation. When the artery was pressed for more than 1 minute the patient fell into a syncope, which continued for 2 minutes. The duration of pressure on the vessel was then reduced to 30 or 40 seconds.

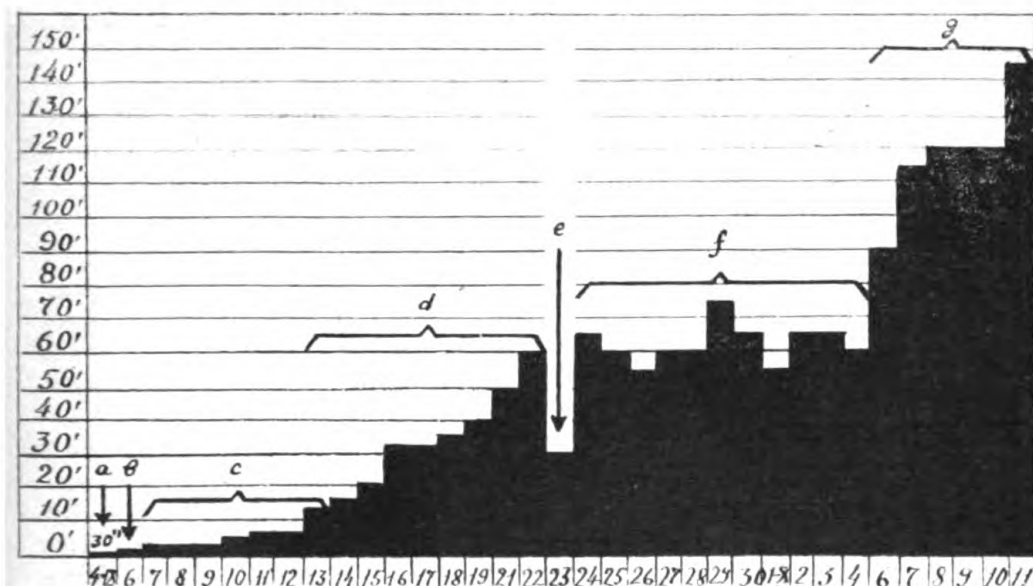
After approximately 3 weeks of the daily use of the compressor, when the progressive compression of the common carotid had been brought up to one hour several times a day, all the deviations on the site of compression and some minor symptoms were recorded on the chart. The pain was easily relieved by narcotics. In a month it was possible to prolong compression on the common carotid up to 2½ hours without evoking complications, after which ligation of the common carotid and the internal jugular vein just above and below the point of connection between the two vessels, with partial dissection of the sac, was done. The result of the operation was the disappearance of the symptoms of arteriovenous aneurysm and there were no more disturbances in the blood circulation of the brain.

This observation leaves no doubt that the primary ligature of the common carotid of this patient would surely have caused a severe disturbance in the blood circulation of the brain.

Other wounded patients bear the compression of the common carotid well and very soon it is possible to compress this artery for a considerable time without any unpleasant consequences and without any signs of disturbance in the blood circulation of the brain. It is impossible, however, to guess in which cases compression of the common carotid for a long time is safe and in which it is not; this can be ascertained only by careful observation during the process of compression.

In the course of compression the limbs often become cyanotic because it may happen that the proximate vein is also pressed; but this does not give any dangerous after-effects. While the vessel is being compressed the limbs must be massaged and warmed.

The compressor does not cause any painful sensations if it is applied for a short time. Sometimes, however, when pressing the common carotid, the patient coughs. This is the result of si-



5. Chart showing the lapse of time from the onset of compression of the right common carotid artery and the evolution of pathologic changes. (a) Syncope lasting 20 minutes; (b) syncope 40 seconds after the onset of the compression relieved by removal of the compressor; (c) hemiparesis of the left side, relieved by removal of the compressor; (d) numbness of left arm and leg, relieved by removal of the compressor; (e) pain at the site of compression, cough, epiphora, right side frontal pain; (f) pain at the site of compression from the onset of the compression, cough, occasional nausea; (g) injection of 1 cc. 1-percent morphine solution 15 minutes after applying the compressing device.

multaneous pressure on the vagus nerve. After a 2- or 3-hour compression some patients have pain at the site of compression; when this is intense the administration of small doses of narcotics is permissible.

After use the apparatus is taken apart and the parts are cleaned with alcohol and put away in their designated nests in a special case. The block, the grooves and the globular nut must be cleaned with particular care. The clamp is left cemented in the plaster bandage, but it is also cleaned with alcohol, especially its grooves, both before and after use.

The efficacy of the compression of the arterial trunks can be demonstrated by feeling the pulse in the distal vessels, or by sphygmographic record of arteries which are difficult to compress, for example the common carotid and the subclavian. When compressing the femoral artery in the region of Poupart's ligament, a sphygmogram of the popliteal artery aneurysm is unnecessary, as the compression of this artery is very simple.

Prolonged application of the compressor in one wounded patient resulted in his complete recovery from arteriovenous aneu-

rysm of the right subclavian vessels as presented in the following case report.

Case 2.—A 39-year-old man was wounded on 3 March 1943 by a shell splinter in the right subclavian region; the wound was blind and nonpenetrating. The hemorrhage was small. After wounding, the right arm hung dead with complete loss of sensitivity in the muscles and joints. In the course of a month the limb gradually recovered in full its power of movement and sensitivity.

Three months later he was under treatment in the Central Naval Hospital (Moscow) where his condition was diagnosed as arteriovenous aneurysm of the right subclavian vessel, for which he had not had any special treatment.

On 1 October 1943 he was admitted to the surgical clinic of the Naval Medical Academy. His general condition was good. In the right Morenheim pit there was a hardened pigmented scar 8 by 2 cm. and a swelling 1 by 1 cm., of cartilaginous consistency, painful and not connected with the clavicle. It was impossible to ascertain the pulsation by manipulating the swelling. Auscultation revealed an intense, incessant, blowing murmur which extended down to the lower third of the right arm and centrally down to the breast. The pulse in the radial artery was distinct.

On 8 October, because of the absence of a compressor, finger pressure was begun, but on 10 November the compressor was put in action on the subclavian vessels. During the compression, which was done 2 or 3 times a day for from 1 to 2½ hours, a feeling of numbness in the patient's fingers and some pain at the site of pressure were observed. From 15 to 17 November the murmur above the aneurysm sac grew feebler and after 26 November entirely ceased. After this the compression of the subclavian vessels was continued for 10 more days. The murmur ceased altogether. On 4 December the patient was sent back to his unit in good health.

The idea of compressing vessels by some mechanical means for stopping hemorrhage is not a new one. Petit quite successfully compressed vessels with his tourniquet. But to develop the collateral circulation one must necessarily use an apparatus which allows compression of a single arterial trunk without disturbing the collateral paths. the vessel compressor proposed by Matas for determining the degree of collateral circulation development can also be used for applying mechanical pressure on the main arterial trunks. Its big defect lies in its unfitness for the compression of the femoral artery immediately under Poupart's ligament, which is necessary for aneurysms occurring at high sites, to say nothing of the fact that it cannot be used for compressing the subclavian artery and the common carotid.

The vessel compressor illustrated allows compression of nearly all the large arterial trunks, such as the common carotid, the subclavian and the femoral arteries. This compressor cannot be used, however, for direct compression of the iliac artery. In cases requiring ligation of the iliac artery, applying pressure to the femoral artery immediately under Poupart's ligament is recommended.

A WIRE LADDER-SPLINT SKIN-TRACTION DEVICE FOR THIGH AMPUTATIONS

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Lieutenant, junior grade (MC) U.S.N.R.

JOSEPH R. KUH

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and

ALBERT L. DAY

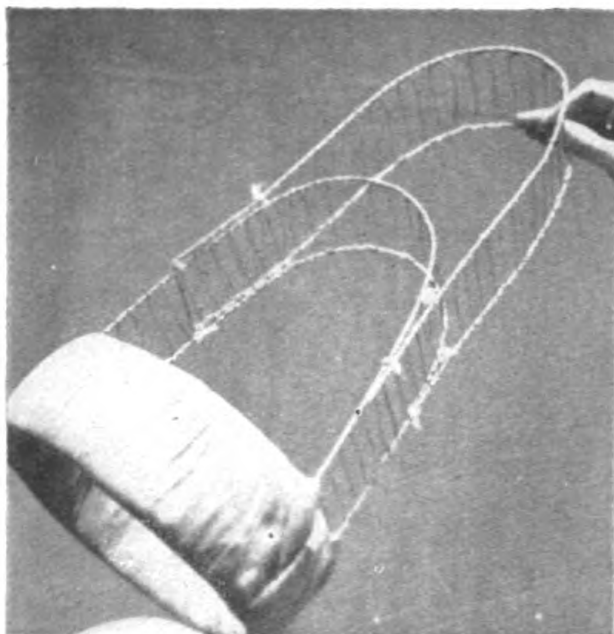
Ensign (HC) U.S.N.

Following thigh amputations of the guillotine type, skin traction should be applied as soon as possible. Relief of pain and added comfort for the patient is thus obtained. Traction, moreover, molds the stump and eliminates or makes easier any secondary operations. Since on shipboard and in the field it may be impossible to apply the usual methods of traction, a makeshift appliance must be used. This should be light, strong, and easily constructed if it is to have an emergency value, and the elimination of weights, plaster, or special equipment is advantageous.

By bending, tying together, and padding three ordinary wire ladder splints a satisfactory traction device can be constructed. One splint is bent and tied to itself to form a circle. On this is attached at right angles another splint bent in a U shape. A third splint, also bent in a U shape, is tied to the second to form an extension for added traction. The circular splint is then well padded, using sheet wadding and bandaging gauze, or any suitable cloth.

In practice, the device is slipped on over the end of the stump and the padded portion worked up high onto the groin, similar to the application of the Thomas splint. Montgomery-type adhesive-tape ties are then applied to the bandaged stump and traction is exerted through them by means of a discarded piece of rubber tubing such as is used for intravenous infusions. This is looped around the extension and knotted on itself, thus giving any amount of traction that is desired.

It is desirable to make the dressing applied after operation



Improved wire-ladder splint assembled for skin traction following amputation.

quite bulky but it should be just small enough to admit the circular part of the splint. This dressing is well fastened with adhesive tape. An advantage of this arrangement is that the initial dressing of the stump may be postponed longer, because the bandage does not quickly become saturated with secretions. The Montgomery tapes hence remain undisturbed, and there is little tendency for moisture to soak them off.

While not primarily designed for other than thigh stumps, this device might be used for either lower-leg amputations or arm amputations, with little modification.



HYPERTHYROIDISM CAUSE OF OSTEOPOROSIS

Hyperthyroidism in the presence of insufficient calcium and phosphorus intake often produces definite osteoporosis which may be detected roentgenologically. Severe cases of osteoporosis may lead to osteomalacia and spontaneous fractures. Gross deformities and dwarfism may result. Practically these complications of hyperthyroidism can be treated best by prevention, with feeding of adequate calcium, phosphorus, and vitamin D, and early diagnosis and treatment of the hyperthyroidism. In late stages orthopedic measures may be necessary.—PUPPEL, D.; GROSS, H. R.; MCCORMICK, E. K.; and HERDLE, E.: Rationale of calcium, phosphorus, and vitamin D therapy in clinical hyperthyroidism. *Surg., Gynec. & Obst.* 81: 243-265, September 1945.

ADDITIONAL OPERATING-ROOM LIGHTING ABOARD SHIP

GARLAND A. GRAY
Commander (MC) U.S.N.

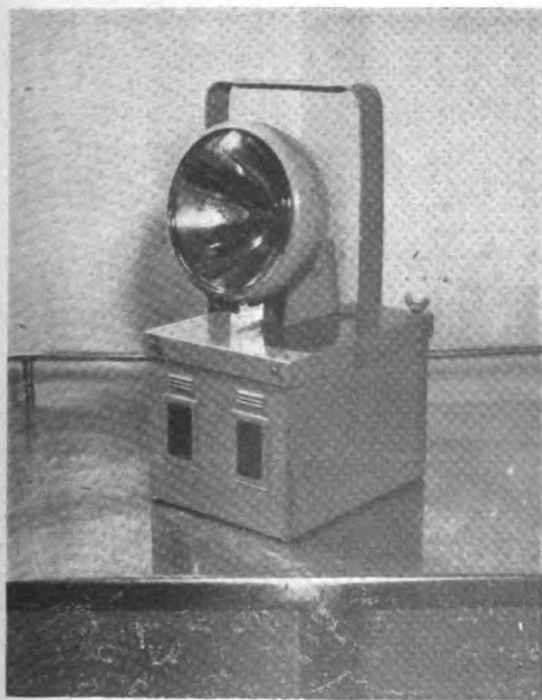
and

CARL O. EDMONDS
Pharmacist's Mate, second class, U.S.N.R.

On this ship, as well as on most others of its class, the operating-room lighting system is connected with the general ship's circuit and in the event of failure of that supply, with an emergency battle circuit.

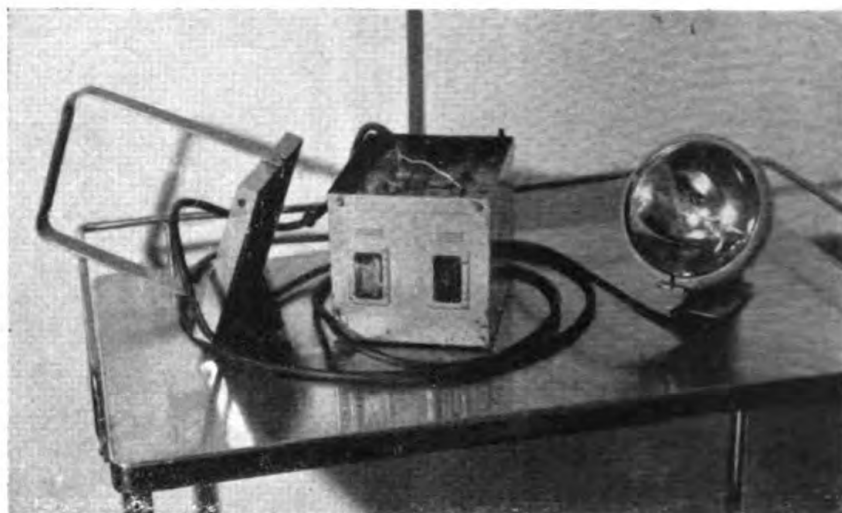
To supplement this arrangement, small battery lights have been fixed to the bulkheads and stanchions at appropriate sites to insure against total darkness should the aforementioned two systems fail. These battery lamps serve just that purpose, but do not suffice to answer the demanding need for a suitable operating light so that surgical work could be continued without interruption.

In searching for a portable battery operating-room light, the electrical division of the ship contributed the battery (wet cell) lamp as seen in figure 1. This lamp gives an excellent spotlight illumination and is available on most combatant ships at this time. The solution of the problem of suitable fixation and location for the lamps may be seen in the accompanying photographs. The ship's electrical division accomplished the removal of the lamp from the battery box, connecting the two parts



1. Portable battery lamp for use in operating room.

with appropriate length of insulated cord as seen in figure 2. By placing a bracket on the base of the lamp and with the use of butterfly bolts the lamp was easily attached to one of the supporting arms of a regular operating-room light (fig. 3). The cord was carried up to the overhead and on over to the battery located



2. Battery lamp disassembled, showing wiring connections to battery and spotlight.



3. Spotlight attached to fixed overhead operating-room lamp. Battery concealed on top of cabinet.

on top of the operating-room supply cabinet, completely out of the way.

This lamp fixation permits four-way movement of the light. It

is depended upon, moreover, as a supplementary spotlight when additional lighting is needed during routine operative procedures. It has the tremendous advantage over the portable standard type of operating-room light in that it does not require deck storage space, nor does it crowd the area surrounding the operating table. Because of the manner in which it is secured, ship movements offer no problem.

The battery will supply current for from 4 to 6 hours and can be changed in 1 or 2 minutes. The old batteries can be re-charged and re-used.



ACCUMULATION OF DDT IN THE BODY

DDT in quantities of significance in its toxicologic evaluation was stored in the body fat of dogs given daily oral doses. The storage increased with dosage level. Feeding oil solutions of DDT gave greater accumulation of the fat than did feeding the undissolved material. The accumulated DDT gradually disappeared from the fat after discontinuation of administration. The milk of lactating dogs receiving DDT or its ortho-para isomer contained appreciable levels of the respective compounds.—WOODWARD, G.; OFNER, R. R.; and MONTGOMERY, C. M.: Accumulation of DDT in body fat and its appearance in milk of dogs. *Science* 102: 177-178, August 17, 1945.



SYNERGISTIC EFFECT OF SULFONAMIDES AND CERTAIN DYES

Sulfonamides which normally have little if any effect against gram-negative bacteria in the presence of 1:28,000 methylene blue or brilliant cresyl blue, completely inactivated 10 million cells of a 24-hour culture of *Escherichia coli* in 10 cc. of nutrient broth buffered at pH 6.8 and containing a final concentration of 1:14,000 sulfapyridine, sulfathiazole or sodium sulfathiazole. Follow-up clinical studies indicate a promising therapeutic value for the combination of sulfathiazole and methylene blue in the treatment of chronic genito-urinary infections by gram-positive bacteria.—THATCHER, F. S.: Synergistic action between sulphonamides and certain dyes against gram-negative bacteria. *Science* 102: 122-123, August 3, 1945.



LIVER EXTRACTS IN BURNS

There is an inhibitory effect on the leukopoietic system frequently demonstrable in burns. This inhibitory effect is characterized by "degenerative" changes in the white blood cells which can be differentiated from the "regenerative" changes resulting from ordinary stimulation. It is suggested that the injection of crude liver extract be combined with the giving of blood transfusions during the toxemic phase because of its known beneficial effect on the degenerative white blood cell picture.—VAN DUYN, J., II: Degenerative white blood cell picture as an indication of toxemia from burns. Arch. Surg. 50: 242-252, May 1945.



GELATIN AS A TOPICAL DRUG VEHICLE

Gelatin appears to be a most desirable vehicle for the presentation of many locally effective drugs. The sulfonamides have been examined, but in addition there are other drugs that might obtain greater utility were they used in a gelatin base. Gelatin approximates the protein composition of the body, it does not produce foreign body reactions when applied to injured tissue fluid, and it carries active agents more readily in this fashion, there being no occlusion.—FLACK, H. L.; CLARKE, D. A.; and TICE, L. F.: Preliminary report of a new gelatin product. J. Am. Pharm. A. 34: 187-190, July 1945.



CHROMOBLASTOMYCOSIS

The eleventh case of chromoblastomycosis on the North American continent is reported. It was featured by papillomatous lesions of over 14 years' duration on the left hand, from where it spread, probably by auto-inoculation, to the other hand, one forearm, foot, ear, buttock and both cheeks. Isolates, obtained several times over a period of 7 years, yielded always deep brown to coal black yeast-bodies in colonies; the latter grew well, were of creamy consistency and glossy, from all biopsies except the last in 1943, when they were rough, dry and slow growing.—BERGER, L.: Chromoblastomycosis due to new species of fungus. Canad.M.A.J. 53: 138-142, August 1945.

EDITORIALS

BED POSITION OF THE SURGICAL PATIENT

From the frequency with which bed posture is specifically indicated on hospital treatment charts, it is apparent that certain fixed opinions are held regarding a patient's position in bed following an operation. Some surgeons have routine orders to the effect that after abdominal operations their patients are to be placed in the so-called Fowler's, Trendelenburg's, jackknife, sitting and other stated positions in bed. The rationale of some of these positions bears review.

Postural methods were founded on the knowledge of the physiologic function of the peritoneum. As this perception widened and became substantiated by fact, bed posture of the postoperative patient was modified accordingly.

In 1863 von Recklinghausen proposed the theory that the rapid absorption of peritoneal fluids was caused by direct communication between the peritoneal cavity and the lymphatic system through open channels or stomas. These were thought to be almost exclusively limited to the area of the central tendon of the diaphragm. It was a matter of reasoning that elevation of the foot of the bed would hasten by gravitation the fluid current to the diaphragm.

Although the method was founded on fallacious grounds, its practical import was first proposed by Clarke in 1897 for the rapid emptying of fluids from the abdomen. Dread of an ensuing toxemia, however, from the quick absorption of toxic fluids through the supposedly sieve-like diaphragm, never popularized the position.

It was left for Trendelenburg, through his recommendation of the head-down position for all operations of the bladder and for laparotomies performed for pelvic disorders as well as a more physiologic concept of the peritoneum, to popularize this position. To effect this posture more readily Trendelenburg designed an operating table which permitted the tilting of the patient from the sitting to the head-down position. The table was first demonstrated in this country before the surgical section of the New York

Academy of Medicine in October 1890¹ and the name Trendelenburg has been irrevocably attached to the postural method of feet elevation.

With the rejection of von Recklinghausen's stoma theory, Fowler in 1900 advocated the exact reverse of the head-down position in the hope that the sitting posture would retard the fluid current to the diaphragm and permit the collection of peritoneal exudates in the pelvis where lymphatic absorption was considered to be at a minimum.

Later the mode of peritoneal absorption of fluid was shown to be almost entirely by way of the blood stream. Deprived of its scientific basis the Fowler position was declared unphysiologic. Subsequently, however, a change of viewpoint emphasized the principles of gravity. The feet-down posture was suggested as conforming to the dynamics of fluids and their gravitation to the pelvis consistent with the mechanics of pooling and abdominal drainage. Thus the term Fowler's position, although founded upon an erroneous concept, has been preserved for posterity.

With more recent studies the function of the peritoneum as an absorbent structure has been clarified. It is improbable, as Dandy and Rowntree² observed, that the 17,000 square centimeters of peritoneal serosa, an area equal to that of the surface of the skin, should be restrictive in its function to the diaphragmatic central tendon area. Utilizing isotonic saline solution containing 0.6 mg. of phenolsulfonphthalein these investigators were able to show that a very active absorption of the peritoneal fluid from 40 to 60 percent occurs in 1 hour, that the absorption in the head-down position is practically the same as in the vertical or dorsal position, and that absorption occurs in the pelvis-down position although in a less amount.

Obviously from these deductions posture may prove propitious in segregating fluids and restricting complications. Peritoneal fluid however is exudative and for this reason the mechanics of fluids do not entirely apply. The mechanism of osmosis and diffusion is more applicable, and what influence gravity may have is effective up to the time that plastic exudates and fibrinous adhesions develop, which is extremely rapid. Moreover the presence of viscera retards further the direction of the flow.

For these reasons modern surgical attitude toward the Fowler or semi-Fowler position is changing. What influence chemotherapy

¹ MEYER, W.: Trendelenburg's new operating table, designed for operations in posture bearing his name. *Med. Rec.* 38: 658-659, December 13, 1890.

² DANDY, W. E., and ROWNTREE, L. G.: Peritoneal and pleural absorption, with reference to postural treatment. *Ann. Surg.* 59: 587-596, January-June 1914.

has had in bringing about this viewpoint is speculative. However, frequent postoperative change of posture is superseding routine employment of Fowler's position, on the assumption that the supine position with head resting on a pillow is the most comfortable for a patient when lying in bed. (S. A. Z.)

GASTRIC PNEUMOGRAPHY

Whether or not the incidence of carcinoma of the stomach is on the upgrade is difficult to determine. From the literature some increase is apparent. Undoubtedly this is not an accurate criterion. With improvement in technical diagnostic aids and a certain cancer consciousness that is taking hold of people through lay press activities, patients are presenting themselves for diagnosis much earlier than was customary a decade ago.

Despite presenting subjective symptoms, however, malignant diseases cannot be established without resort to a number of mechanical devices, foremost among which is roentgenography. Even here no direct evidence of a growth is obtainable. Roentgenograms evolve around the study and interpretation of shadow images, the inconsistencies of which may be seen from observations of the sun's shadows; the size, shape and objective appearance is dependent to no small extent upon the inclination of the sun.

An understanding of the difficulties involved in a differential diagnosis of deformities of the upper alimentary tract may be seen readily from Poppel and Roach's article elsewhere in this BULLETIN, p. 1111. The many maneuvers at the roentgenologist's disposition are considered and evaluated. Unfortunately some are only infrequently employed, among these gastric pneumography. No attempt apparently has been made to evaluate the advantages of this method. At least the American literature is wanting in this respect, and as Thomas¹ has pointed out, the method is referred to only "for the sake of completeness."

It is agreed that where there is so much difficulty in arriving at a diagnosis any additional information which can be obtained by a different method of examination must be worth seeking.

Pneumography is beset with difficulties but the supplementary diagnostic value in the localization and diagnosis of enlargements within and adjacent to the stomach is without parallel. Gastric pneumograms are particularly valuable in enabling a detailed

¹ THOMAS, S. F.: Value of gastric pneumography in roentgen diagnosis. Radiology 45: 128-137, August 1945.

study of the retrogastric spaces and in revealing tumors of the pancreas.

With simplification of the method of distending the stomach by a small-caliber stomach tube, more control over the insufflation of air into the stomach is possible, undue distress to the patient is avoided, and more precise pneumograms are obtainable. The method constitutes a very definite advancement in roentgenography. (S. A. Z.)

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.
(For review)

PENICILLIN AND OTHER ANTIBIOTIC AGENTS, by *Wallace E. Herrell, M.D., M.S., F.A.C.P.*, Assistant Professor of Medicine, the Mayo Foundation, University of Minnesota; Consultant in Medicine, Mayo Clinic, Rochester, Minnesota, 348 pages; 45 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1945. Price \$5.

This book has been divided roughly into three sections. In the first of these the author has sketched the highlights in the development of our knowledge of antibiotics, particularly penicillin, and has covered such fundamental factors as preparation, assay, chemical properties, biologic activity, and pharmacology. The second section deals with the clinical use of penicillin and is quite complete both in the description of technics and in the consideration of results. The final six chapters are devoted to summarizing our extremely fragmentary knowledge of antibiotics other than penicillin.

The monograph is useful in that it summarizes completely our knowledge of the antibiotic group up to about July of 1944. The entire field is developing so rapidly that much of the text is already far outdated and leaves one with much the same sensation as might be derived from reading a summary of the serum treatment of pneumonia. To cite an example, penicillin is treated as a homogeneous substance although now we know it to be a group of related compounds, each with its own characteristics and field of effectiveness. The section on clinical use also demonstrates the rapidity with which our knowledge has increased; for instance the role played by the drug in war surgery is hardly mentioned. One fault, common to many monographs of this type, is especially evident. The author has been so diligent in compiling a complete

review of the literature that he has slighted the far more interesting factor—his own detailed clinical experiences. A day-by-day account of the course of two or three patients with acute mastoiditis is much more convincing than a list of references to the work of others—one can always obtain these from the Cumulative Index or from drug house brochures but we buy a man's book to learn of his views and experiences.

Omissions are few; there is considerable reference to the use of penicillin when the infecting strain of an organism can be shown to be susceptible to its action, but there is very little discussion of how this susceptibility might be determined. More detailed consideration of augmentary measures in penicillin therapy would be welcome—diet, plasma, blood, chemotherapeutic agents, and biologics. Also some comparison, if only by impression, of the results of penicillin therapy and older methods. These might have occupied the space wasted by duplicating bibliographic entries at the conclusion of each chapter.

The publishers have done an adequate job; the paper is good once one becomes used to the glare, the index is complete, and the color reproductions are excellent. This little book can be recommended to those interested in a basic consideration of penicillin therapy and a review of the literature prior to August 1944. Until the field stabilizes a little, nothing but glorified progress reports can possibly be got out in book form; the author has done a good job with the information at hand.

PENICILLIN THERAPY, Including Tyrothricin and Other Antibiotic Therapy, by John A. Kolmer, M.S., M.D., Dr.P.H., Sc.D., LL.D., L.H.D., F.A.C.P., Professor of Medicine in the School of Medicine and the School of Dentistry, Temple University. 302 pages; illustrated. D. Appleton-Century Co., Inc., New York, publishers, 1945. Price \$5.

This book is the first monograph published on this subject and is very entertaining to read. Dr. Kolmer has done an excellent piece of work; he has studied all the literature on penicillin and quotes very extensively from it. He has gone into a thorough discussion of the production of penicillin, methods for its detection and assaying, its physical and chemical properties, its antimicrobial activity in vitro and vivo, its pharmacology and toxicity, its administration and dosage and the principles of penicillin therapy.

The clinician is much more interested in its use in specific diseases. A separate chapter is devoted to its use in staphylococcal, streptococcal, pneumococcal, meningococcal, gonococcal and clostridial diseases, in wounds, burns, and syphilis. Equally instructive is a chapter devoted to its use in miscellaneous diseases in most of which it is of no value, but it is equally important to know when not to use penicillin as to when to use it.

The properties and clinical application of tyrothricin, gramicidin S, streptothricin, patulin and chlorophyll are thoroughly gone into, their use at the present time being limited to local application.

Dental officers will be very much interested in a chapter devoted to penicillin and tyrothricin therapy in relation to dentistry and oral surgery. Kolmer lists a whole page of oral conditions suggesting which drug to use and its method of administration.

THE COMPLETE PEDIATRICIAN, Practical, Diagnostic, Therapeutic and Preventive Pediatrics for the Use of Medical Students, Internes, General Practitioners, and Pediatricians, by *Wilburt C. Davison, M.A., D.Sc., M.D., Professor of Pediatrics, Duke University School of Medicine, and Pediatrician, Duke Hospital*. 4th edition; second printing. Duke University Press, Durham, N. C., publishers, 1944. Price \$3.75.

The title of this book is most appropriate. Already in its fourth edition, second printing, it has been so widely acclaimed that new and original praise is difficult to express. Otherwise it is easy to eulogize such a work about which there is so little disagreement even among doctors, who are famous for their healthy inability to agree on anything.

The amount of information in such a small book is literally astounding. This, however, is readily available, due mainly to an original and clever system of annotations, numerals, and index. It easily fits in the desk drawer or small medical bag, where it belongs, for constant reference. What the *Encyclopedia Britannica* is to the layman, this book is to the medical man.

Few of us these days escape the occasional lapse of memory that afflicts the busy clinician. This book is the antidote—an un-failing bulwark in time of need. Possibly a new remedy is desired when all previously tried have failed, or it may be necessary to look up some pediatric oddity or rarity. As a professor in medical school once said, "Gentlemen, my purpose is not to crowd your head with facts but to teach you where to get them when needed." In fact, this book is a source of almost everything but judgment and experience. The latest edition, of course, contains up-to-date information on the present status of the sulfa drugs and penicillin.

A friend once told me that when in a hotel room in a strange city he put himself to sleep reading the telephone directory. With this book one would be more likely to continue reading all night.

THE NEW-BORN INFANT, A Manual of Obstetrical Pediatrics, by *Emerson L. Stone, M.D., Associate Clinical Professor of Obstetrics and Gynecology, School of Medicine, Yale University*. 3d edition; thoroughly revised. 314 pages. Lea & Febiger, Philadelphia, Pa., publishers, 1945. Price \$3.25.

Few textbooks have been written concerned solely with the medical problems and treatment of the newly born infant. The

reviewer believes this book adequately fulfills such an important need. Its perusal should benefit the obstetrician and pediatrician as well as the general practitioner in the handling of the newborn, since it bridges so well the transitional period from shortly prior to the baby's birth until a few weeks afterward, during which time the infant is becoming rapidly adjusted to extra-uterine existence. Too often the newborn is a victim of some neglect.

The text is written in a clear, easily read style without being verbose. Much of the pertinent literature on the subject is concisely reviewed and the references listed in footnotes. No significant errors in the text were noted. Although no lengthy discussions of controversial points are entered into, the known essential facts are covered, albeit rather sketchily in some instances. The importance of the obstetrical factors influencing the state of the newborn well deserve the studied consideration of the obstetrician with the harmonious cooperation of the pediatrician. The "common-sense" attitude in handling the newborn child maintained throughout the text proves refreshing.

MASS RADIOGRAPHY OF THE CHEST, by *Herman E. Hilleboe, M.D., Medical Director, Chief, Tuberculosis Control Division, United States Public Health Service; and Russell H. Morgan, M.D., Surgeon (R), Medical Officer-in-Charge, Radiology Section, Tuberculosis Control Division, United States Public Health Service.* 288 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1945. Price \$3.50.

This excellent volume has been read with great interest because, as stated by Dr. Chamberlain in the foreword, the project is "timely."

The chapter on the history of mass radiography gives a concise and comprehensive review of the development of photofluorographic equipment and technic. However it is the reviewer's opinion that more space might have been given to the excellent and painstaking work done by the Naval Medical School group since 1939; the authors mentioned only the condensor-discharge x-ray equipment, whereas, in fact, early in the game, the greater part of Naval photofluorographic equipment was of the conventional 200 ma. type, with photofluorographic attachment designed and built by the Navy.

The objectives of tuberculosis control are listed as case-finding, medical care and isolation, aftercare and rehabilitation, and protection of tuberculous families against economic loss. Each of these subjects is well covered. One statement on page 22 might be questioned, and is quoted as follows: "It is significant, however, that despite improvements in methods of diagnosis and treatment, no real contribution has been made in the field of prevention." It is assumed that the authors exclude from consideration human

disease caused by the bovine strain of the tubercle bacillus, the eradication of which constitutes a brilliant chapter in American preventive medicine.

The remaining chapters concerning preliminary planning for mass radiography in the community, equipment available for mass radiography, photo-timers and automatic cameras, physical factors affecting choice of equipment, design for mass radiographic installations, roentgen technic in mass radiography, roentgen diagnosis of the chest, and record and filing systems for mass radiography, create an admirable handbook which should prove of great value to public health and private organizations confronted for the first time with all the puzzling problems arising from attempts to obtain mass examinations of the chest in industry, communities, and institutions.

Worthy of particular mention is the collection of cuts making up an atlas of chest x-ray. The cuts are reproduced with a clarity of detail which is most unusual.

DIETOTHERAPY, Clinical Application of Modern Nutrition, edited by *Michael G. Wohl, M.D., Associate Professor of Medicine, Temple University School of Medicine*; with a foreword by *Russell M. Wilder, M.D., Ph.D., Professor of Medicine and Chief of the Department of Medicine, Mayo Foundation*. 1029 pages; 93 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1945. Price \$10.

Attention to the problems of nutrition has been brought about by many factors. Among those that may be specified are the recent calling of the United Nations Conference on Food and Agriculture, the formation of the Food and Nutrition Board of the National Research Council, the emphasis upon physical fitness projects, the rationing programs engendered by the war, and the stress placed upon sundry nutriments, especially vitamins, by displays in the newspapers and stores. Although the onset of the recent war was the prime cause of the quickening of interest, that alertness will not become moderated with the cessation of the conflict; for the problems of providing for the peoples of the nations lacerated by war will be emphasized, rather than mitigated, in the immediate future. Thus, if only for those reasons, every physician should have a clear conception of the elements of nutrition. Unfortunately the information on that subject has been discordant and scattered widely throughout many books and journals. Only a few comprehensive, yet lucid and understandable, accounts have been written. This book represents an effort to bring order out of disorganization.

The policy of having experts review their special fields for inclusion in a text dealing with a branch of medicine has been long

fixed. That is laudable, provided the reputation of the authors is established, and that the units are edited sufficiently to weld them into an easily-readable cohesive whole. The book qualifies on both requirements. To aid in the preparation of the volume, the editor enlisted the cooperation of many of the more important investigators in the field of nutrition. Every one of the 58 authors is a leader in his respective field of endeavor, and from his experience has delivered a commanding and timely discussion of his subject. The fact that Wilder wrote the foreword gives his seal of approval to the work.

The book is divided into 3 parts. The first portion contains a discussion of normal nutrition, and in it are examinations of the normal diet, the physiology of the gastro-intestinal tract, water metabolism, the functions of protein, carbohydrate, fat, and minerals in nutrition, and finally the role of vitamins in health and disease. The second section embodies a series of discourses on nutrition in the periods of physiologic stress: Pregnancy, childhood, age, infection, and athletic activity. The last part incorporates a succession of discussions on the disease in which the correct diet plays a role. At the end of each chapter there is an extensive bibliography, each containing an average of 50 to 75 references. The 93 illustrations are uniformly good. The inaccuracies that are usual in first editions are absent.

In these days of wartime duties it is to the credit of Doctor Wohl that he was able to persuade extremely busy men to write an intelligible, comprehensive analysis of the current opinion in nutrition. In a word, Doctor Wohl has collated the material for an excellent treatise that is a welcome addition to the literature on nutrition.

RADIOLOGIC EXAMINATION OF THE SMALL INTESTINE, by *Ross Golden, M.D.*, Professor of Radiology, College of Physicians and Surgeons, Columbia University. 239 pages; illustrations of 183 subjects in 75 figures. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1945. Price \$6.

This book fills a long-felt need for a competent and complete roentgenologic consideration of the small intestine. Concern and interest regarding this field have been growing and a large amount of material has been published here and there. Now we have in this small volume a convenient and authentic reference which brings most of the material into clear focus and should prove of greatest value.

Treatment of the subject is complete and systematic. The illustrations are adequate. Technic is well described. Anatomy and physiology, including embryologic features, are not omitted and the discussion of physiology is especially good.

A valuable feature is a thorough consideration of the Miller-Abbott tube and it might also be noted that there is ample description of nutritional disturbances, allergy, and effects of drugs as well as a very complete bibliography.

In general this is a book which the roentgenologist will find most profitable to have at his elbow; nor will the gastro-enterologist and the abdominal surgeon find it unworthy of a most careful perusal.

A TEXT-BOOK OF ORAL PATHOLOGY, by *Thomas J. Hill, D.D.S., Professor of Clinical Oral Pathology and Therapeutics, Western Reserve University, Cleveland, Ohio.* 3d edition, thoroughly revised. 407 pages; 332 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1945. Price \$6.50.

As Dr. Hill states in his preface to this third edition, the book is intended primarily for undergraduates. However there are some chapters that may be informative and useful to graduates for purposes of review.

The chapters on dental caries are excellent. They cover all the research and experiments on the etiology and pathology of caries, in addition to the latest concepts on the effect of fluorine in the control of caries. Diseases of the dental pulp are treated in a way that is more readily understood than most other textbooks on the subject.

The chapters on abnormal development of the oral region and abnormalities of dentition touch too lightly on involved and complex subjects. The same is true of the section on malocclusion and dentofacial deformities. The reviewer feels that more space should have been given to the study of progressive tissue changes; the section on cysts, for example, is little more than an outline.

In summary the book is a good practical guide in oral pathology for the undergraduate. This new edition reflects the results of many recent investigations and contains an abundance of new references.

NURSING IN CLINICAL MEDICINE, by *Julius Jensen, Ph.D. (in Medicine), M.R.C.S. (Eng.) L.R.C.P. (Lond.), Assistant Professor in Medicine, Washington University, St. Louis; and Deborah Maclurg Jensen, M.A., B.Sc., R.N., Lecturer in Nursing Education, Washington University, St. Louis.* 2nd edition. 829 pages; illustrated. The Macmillan Co., New York, publishers, 1945. Price \$3.50.

This book is well adapted as a text for student nurses in clinical medicine. It demonstrates simplicity and conciseness without loss of scientific accuracy.

The orderly unit presentation and varied illustrations stimulate interest and clarify difficult subject matter.

The suggested questions and references at the completion of

each unit are most helpful to both student and instructor in summarizing the most important points.

The section entitled Dietary Index is of particular value as a supplementary reference enabling the reader to correlate feeding problems with nursing care.

The medical nursing procedures contained in the appendix enhance greatly the use of this book as a nursing text.



PENICILLIN IN INTESTINAL OBSTRUCTION

Bacteria or their products in the presence of distention are responsible for the "toxemia" and death in dogs with isolated obstructed intestinal loops. Large doses of penicillin given prophylactically, whether locally or parenterally, will prevent "toxemia" and death in dogs with isolated obstructed intestinal loops for a significant period of time. It is emphasized that no conclusions regarding the efficacy of penicillin in intestinal obstruction in man can be drawn until studies on simple obstruction now in progress have been completed.—HARPER, W. H., and BLAIN, A. III: Effect of penicillin in experimental intestinal obstruction. Bull. Johns Hopkins Hosp. 76: 221-242, June 1945.



ULTRAVIOLET EFFECTS ON LIVING CELLS

Ultraviolet radiation produces injurious effects on living systems in general, indicating that this agent acts upon some component of all cells. Systems comprised of single cells such as bacteria, protozoa, etc., lend themselves to the study of action spectra for injurious and lethal effects. All these action spectra show remarkable similarity to the absorption spectra of typical unconjugated protein or of nucleic acid. The universal importance of these two substances, their presence in quantity in all cells, and the fact that both are photolabile, leads to the conclusion that ultraviolet radiation exerts its injurious action by altering either or both.—BLUM, H. F.: Physiological effects of sunlight on man. Physiol. Rev. 25: 483-530, July 1945.

PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge

INFECTION OF WILD RATS ON LEYTE WITH SCHISTOSOMA JAPONICUM¹

THOMAS B. MAGATH
Commodore (MC) U.S.N.R.
and
DON R. MATHIESON
Lieutenant (MC) U.S.N.R.

Various authors have reported the presence of *Schistosoma japonicum* in both domesticated and wild animals. Dogs, cats, cattle, horses, deer, pigs, goats, sheep, and field mice (in China) have been found to harbor the parasite. Mice, white rats, hamsters, guinea pigs, rabbits, and monkeys have been infected experimentally. In Leyte, according to available information, dogs, young water buffalo (carabao), and young pigs have been found infected. As is well known, the endemic area for man is limited to the Leyte Valley, an area approximately 25 miles long and 8 miles wide on the east side of the island. It appeared to be worthwhile to examine a number of wild rats from various locations within the valley and elsewhere in order to determine (1) if wild rats were infected and (2) if the incidence of infection followed the distribution of *Schistosomophora quadrasi* and the known endemic centers of the disease in man. Further it was hoped that such a study might reveal the identity of specific bodies of water in which infection might be acquired.

Man and domestic animals, because they are not always indigenous to the area in which they are found, cannot be used as an absolute index of the infectivity of given bodies of water. With the abrupt dispossession of homes due to the war, the population of Leyte has undergone a great deal of displacement. Domestic animals are frequently traded and bought in markets removed from the domiciles of the owners and such animals very often run at large over a wide area. Conditions do not usually permit one to ascertain the most probable location where the person or ani-

¹Contribution from U. S. Naval Medical Research Unit No. 2.

mal became infected. While it is known that rats, under certain conditions, undertake wide migrations, such circumstances do not appear to exist in Leyte where the temperatures remain relatively constant throughout the year and the presence of food, at least in the Valley, appears to be evenly distributed. All of the evidence supports the conclusion that wild rats on this island live their lives within a relatively small area.

LOCATIONS STUDIED

Rats were trapped by the local Navy Rodent Control Officer² in the following eight general areas:

1. Tacloban, a city in which there is no record of persons contracting the disease and located within a large area in which the intermediate host has not been found.

2. Palo, a village located on the Palo River in an area commonly referred to as highly endemic. Although the snail has never been taken from the river for many miles adjacent to the city, it has been found in abundance in small creeks, ditches and swampy areas on the edge of the village. The percentage of human infection in the village before the war was estimated to be above 50 percent.

3. Gacao, a small barrio settlement 3 miles southwest of Palo where our search revealed the presence of *S. quadrasi* in abundance and with an infection rate of 4.5 percent. Two stool specimens from children living within a few feet of the creek and adjacent swampy area from which these snails were collected contained ova of *S. japonicum*. A large number of persons in this area are known to have the disease.

4. Dagami Region, containing an inland village long known to be heavily infected with the parasite and where some surveys have revealed that almost every child under the age of 15 years has acquired the infection. The actual area in which traps were set was 3 miles distant from the village and at the location of a Naval radio transmitter station. It has been reported that 17 of the 19 cases of schistosomiasis in Naval personnel were acquired here and that every child, except two, who lived in the locality now occupied by the station, harbored the parasite.

5. Santa Fe, a village 6 miles northwest of Palo and on the north edge of the Leyte Valley. The population of this village has had the reputation of being heavily infected and patients from it have been observed by us. *Schistosomophora quadrasi* was found in small streams both east and west of the barrio area.

² Ensign Lloyd E. Ulbrich H(S) U.S.N.R.

6. Alangalang, a village 5 miles northwest of Santa Fe and near the middle of the Valley. Specific snails were taken by us immediately to the north of the village, and patients suffering with schistosomiasis from this area were present in local civilian hospitals; the area has been known to be one of high endemicity.

7. San Antonio, Samar, a small barrio on the southeast shore of the island. No known cases of schistosomiasis have come from this area and the specific snail is absent from the region.

8. Jinamoc Island, a small island off the southeast coast of Samar. A small village is located on the northeast corner; no cases of schistosomiasis have been found on the island nor has the intermediary host.

In Tacloban, the rats were procured from 4 sources: (1) The Naval Operating Base located on the south end of the San Juanico Straits and devoid of fresh water swamps and streams; (2) the Transient Camp located 3 miles from the city in a coconut grove with swamps adjoining it; (3) the Base K area just outside the city where there is a small amount of swamp land but in which schistosomophora has never been found; and (4) from within the city itself. In the Palo area, most rats were taken from the north bank of the river and two were obtained from the south bank. The river banks are heavily populated and dozens of people may be seen at any hour of the day bathing and washing clothes in the river. Most of the town lies on the south bank of the river. Some of the rats were procured from a more or less isolated barrio area on the south edge of the village alongside a small swamp. This area was about 1 mile from the river. On the edge of this swamp, stools of human beings and pigs were collected which contained the ova of *S. japonicum*. The intermediate host obtained from this area revealed an infection rate as high as 21 percent. In Gacao the rats were obtained on grassy mats within the creek itself and in the swampy area adjacent thereto. Frequently the traps were set in such a position that the rats must have been exposed to the water to have reached the bait. Some rats were obtained from a portion of the swamp in which cercariae of *S. japonicum* were obtained free in the water. At the radio transmitter station, rats were collected along the river and along a creek at the junction of which Naval personnel were in the habit of bathing during the construction period of the station. Rats were also obtained from an area about the antenna poles, which, at the time of installation, was said to have been flooded with water. The specific snails during the months of June and July were not found in the river or creek but were present in a drainage ditch and adjoining swamp within one-half mile of the anten-

na system. Snails taken from the river during the winter months and first identified as *S. quadrasi*, proved to be young shells of a species of *melania*, common in the river.

In Santa Fe the rats were taken in the region of a trash pile situated near swampy land on the east edge of the village. The rats from Alangalang were procured from a region near a small stream near the area in which the intermediate host had been found. Those from San Antonio were obtained on the outskirts of the barrio consisting of approximately 100 nipa huts. The rats from Jinamoc were trapped on the edge of a swamp just outside the barrio.

METHODS

Rats were brought to the laboratory, anesthetized, if not already dead, opened and examined. Small pieces of liver and spleen together with a liberal portion of the rectum were pressed out between slides and examined under the microscope for the presence of ova of *S. japonicum*. At first, and until it was considered no longer profitable, a cover-glass preparation was made of the rectal fecal material, without its being concentrated, for examination. Hydrochloric acid-ether preparations were made of the material in every instance. Lung tissue, mesenteric lymph nodes, and the stomach and intestinal wall were also frequently examined by the compression method. When ova were found in the liver (except in 5 instances), a search was made of the mesenteric vessels for the presence of adult worms. This search was made under a binocular dissecting microscope after the veins were opened with iris scissors or sharp needles.

RESULTS

One hundred sixty-three rats were examined from the 8 areas between 8 June and 2 August 1945 (table 1). None of the 58 rats from the Tacloban area showed evidence of infection with *S. japonicum*, nor did the 26 rats from the Palo River. Eleven of the 17 rats obtained from the barrio region in the village were infected. Thirty-seven of the 41 rats examined from Gacao revealed infection, while 4 of the 7 collected at the radio transmitter station were infected. Of the 12 rats collected at Santa Fe, 10 were infected as were 2 of the 4 from Alangalang. None of the 6 rats obtained from San Antonio and neither of the 2 obtained from Jinamoc Island revealed an infection. It was observed that rats showing the least amount of infection and apparently the earliest infections, could be detected by examination of the posterior central lobe of the liver. Rats showing infection never failed

to have eggs in this lobe. Next in frequency to exhibit the accumulation of eggs were the other lobes of the liver and the rectal wall. Other parts of the body frequently showing the presence of eggs were the spleen, mesenteric lymph nodes, the lung, and various parts of the gastro-intestinal tract.

In heavily infected rats, the gross pathologic changes in the liver were pronounced. The liver exhibited a high degree of portal cirrhosis and grossly visible accumulations of eggs and pigment. In such animals the spleen also revealed accumulations of eggs, and sclerotic changes. The mesenteric blood vessels were frequently thickened, pigmented, thrombosed and occasionally the lumens were nearly obliterated. Mesenteric lymph nodes were enlarged and pigmented, while around their periphery a narrow yellow zone could be seen which proved to be nests of eggs. Upon

TABLE 1.—Results of examination of wild rats* for the presence of *Schistosoma japonicum*

Location examined	Rats examined	Positive liver	Positive rectal wall	Negative rats	Positive rats	Positive rats, percent
TACLOBAN:						
NOB area	18			18		
Transient camp	18			18		
Base K area	18			18		
Native city	4			4		
Total	58			58		
PAJO:						
River—north bank	24			24		
River—south bank	2			2		
Swamp—barrio area	17	11	6	6	11	63.4
Total	43	11	6	32	11	
GACAO:						
Barrio area	41	37	30	4	37	90.2
DAGAMI:						
Radio station	7	4	3	3	4	57.1
SANTA FE:						
Barrio area	12	10	7	2	10	83.3
ALANGALANG:						
Barrio area	4	2	2	2	2	50.0
SAN ANTONIO, SAMAR:						
Barrio area	6			6		
JINAMOC ISLAND:						
Barrio area	2			2		
Total	163	64	48	109	**64	

*Ten were Polynesian rats, 14 were Norway rats, and 139 were black rats. The sub-species were not determined.

**Adult worms were found in 59; no search was made in 5 rats.

dissection of the mesenteric vessels, adult worms were found in the portal, superior or inferior mesenteric veins or partially in the first branches thereof. No worms were ever noted in the smaller branches of these vessels either in the mesentery or the gut wall, but worms were encountered in the portal circulation of the liver.

Ova were demonstrated in feces in only two instances; once in

an unconcentrated specimen and once after concentration. On both occasions only one ovum was found in a single cover-glass preparation.

An examination of the stomach contents of the rats revealed that about half of them had eaten snails.

COMMENTS

It is apparent from the evidence presented that the wild rat is a frequent host of *Schistosoma japonicum* in areas in which the life history of the parasite is being completed on Leyte. It is further evident that there is a strong suggestion, despite the limited number examined, that the wild rat may serve as a useful index animal in determining areas in which the life history of the trematode is being completed. From the rarity with which eggs are found in the feces of the rat, it may be anticipated that this animal does not act as a reservoir host and therefore it becomes a more important index animal than otherwise, since it does not contribute to any significant extent in the infection of snails.

It was not possible to obtain a sufficient number of eggs from the feces of rats to test their hatchability. However since eggs contained miracidia and since on several occasions we were able to hatch out large numbers of miracidia from eggs obtained from the liver, there is no reason to suppose that the rat could not act as an agent to spread the disease if it excreted eggs in its feces in quantities. It is well known that man, pigs, and dogs excrete large numbers of eggs in their feces, especially when heavily infected, and that a large percentage of these eggs are capable of hatching if placed under the proper conditions. It appears to us that the reason eggs are not generally excreted in rat feces is due to the fact that the caliber of the vessels of the rat bowel is too small for the female worm to enter, and the deposition of her eggs in the vessels nearer the portal vein results in most of them being carried to the liver. This failure to enter the smaller vessels of the bowel wall may not allow sufficient pressure to be exerted on the eggs to force them through the bowel wall, and gross inspection of the mucosa never revealed lesions so commonly seen in the lower bowel of man and the dog.

It is the intention of the authors to pursue the problem further so as to determine whether or not the wild rat may be used to outline areas in which the life history of the parasite is being completed. Rats in these parts of the world are usually "sylvatic" in habitat and readily procured in reasonably large numbers by

those who are expert in rodent control. Furthermore they can be examined quickly for evidence of infection and are not subject to commercial transactions or to social visitations at great distances. In order to make a survey of any given population, it is difficult to obtain fecal specimens from a representative group of natives and to obtain reliable histories which will reveal the locality in which a person acquired the infection. Similarly the examination of the feces of dogs, carabao, and pigs does not reveal the area in which the animal acquired the infection, as these animals frequently wander over wide areas and are transported for sale over relatively great distances. A study of the distribution of the snail responsible for the transmission of the disease is not a simple procedure; it is not only necessary to find the particular snail but large numbers must be crushed and examined to determine whether they are infected with cercariae.

Examinations for the presence or absence of the intermediate host has led to confusion regarding the infectivity of a region. It has been contended, for example, that a large number of military personnel have become infected by bathing in rivers in which these snails have never been found or have only been found a considerable distance away in the swamps or contributory drainage systems. In spite of the fact that we have been able to demonstrate cercariae in natural waters, such demonstrations have been rarely recorded by others; and to our knowledge, cercariae have never before been demonstrated in natural waters on the island of Leyte. Perfection of our technic may result in more certain demonstrations of these plankton forms. However at the present time no practical method is proposed for this purpose.

The study of schistosomiasis in wild rats has further suggested the possibility of determining whether or not the disease is usually acquired in the "wetter" season as has been suggested by certain evidence. A study of the incidence of the infection in rats by months in a localized area would be far simpler than a study of seasonal infection in the native human population.

CONCLUSIONS

1. Wild rats have been shown to be a host for *Schistosoma japonicum* in Leyte.
2. The feces of wild rats rarely contain the ova of the parasite; hence, the wild rat does not appear to be a disseminator of the disease to any appreciable extent.
3. From a preliminary investigation it appears that the wild rat might be used to define a limited area in which the life history of *S. japonicum* is being carried out. The percentage of rats

infected with the parasite might also be an indicator of the intensity of the infection in the area. When infected rats are found, it is almost conclusive evidence of the presence of ova in feces from man, or animals other than the rat, and their entrance into local waters in which the intermediate host is present and shedding cercariae.



SALIVARY SULFATHIAZOLE LEVELS WITH GUM

Eighty-four subjects were used in an effort to study the sulfathiazole-saliva levels during the mastication of sulfathiazole gum tablets. Total and dissolved sulfathiazole, salivary volume, and pH were determined at 5-, 10-, 15-, 20-, 25-, 30-, 40-, 50-, and 60-minute intervals. The calculated average salivary concentration of dissolved sulfathiazole for the entire 60-minute test period in the group using one sulfathiazole gum tablet was 67.1 mg. per 100 cc. of saliva. Increasing the available number of tablets to 2, and thus doubling the potential dose in a group of 10 subjects, resulted in a calculated average salivary concentration of dissolved sulfathiazole of 78.4 mg. per 100 cc. of saliva. These findings are in agreement with those previously reported by Fox and his collaborators.—HARRISON, J. W. E., and REES, E. W.: Study of salivary sulfathiazole levels produced by sulfathiazole gum. *Am. J. Pharm.* 117: 204-209, June 1945.



INTRAVENOUS ALCOHOL AND GLUCOSE IN PNEUMONIA

There was described, many years ago, a method of conservative treatment of purulent pneumonitis by intravenous injections of alcohol and glucose; this method has again been used with good results in severe cases of pneumonia. The method consists in intravenous injections of 25 cc. of pure alcohol added to 100 cc. of 20-percent glucose. Four cases of postoperative pneumonia have been described in which, in addition to the routine sulfonamide treatment, from 1 to 3 injections had been administered. Based on previous experience with alcohol treatment and on these 4 cases, it is assumed that, under the combined sulfonamide-alcohol treatment, not only the number of sulfonamide-resistant cases will considerably decrease, but also the process of resolution will be simultaneously markedly shortened.—LANDAU, A.: Combined treatment of pneumonia by sulfonamides and intravenous injection of alcohol and glucose.—LEKARZ WOJSKOWY: *J. Polish Army Med. Corps.* 36: 122-127, August 1945.

FIVE YEARS OF PHOTOFLUOROGRAPHY IN THE NAVY

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It is now over 5 years since the Navy embarked on miniature photofluorography of the chest, and it is appropriate to review progress.

The lessons of World War I and the experience following it indicated clearly the magnitude of the problem of tuberculosis. The tendency for these cases to progress rapidly under the rigors of Naval service needed no arguing, so that it was natural that as the ominous signs of the recent war became many and more apparent, serious concern was felt.

The studies made during and since World War I proved physical examination to be totally inadequate for purposes of tuberculosis case-finding. Furthermore fluoroscopy could not answer, both by reason of insufficiency of trained personnel and also because the accuracy of this method still leaves much to be desired. Therefore recourse to some type of radiographic examination of the chest was clearly established as the best answer to the problem, and the main question related to practical means of applying it.

The use of 14 by 17-inch films on a large scale was known to be extremely expensive as well as to entail heavy demands on the score of personnel, critical material, equipment, and filing space. Accordingly, it was decided to experiment with the use of 35-mm. film for photography of the fluorescent image along the lines of de Abreu's (1) (2) work in Brazil which was bringing to fruition the pioneer work of Caldwell (3) done in our country a quarter century ago, and the earlier experiments of others. The results of studies made in the old Naval Hospital and Naval Medical School in Washington in 1939 were very favorable, as reported by Chambers and Behrens (4) in 1940.

As a result seven units were placed in service and accomplished a huge amount of valuable work, despite the difficulties of embarking on a new course in the face of lack of experienced personnel.

Due to various factors, a complete statistical analysis of all work is impracticable at the present time. However an analysis by Duncan (5) showed that up to 1 April 1942 a total of 247,257 examinations was recorded in the case of recruits who, be it remembered, had already passed the usual physical examinations. In this group 273 cases of active tuberculosis were found and 786 cases of inactive involvement, percentages being 0.12 and 0.32 respectively. Thus 1,059 persons were detected either having active tuberculosis or with a dangerous liability of developing it. This represents an enormous financial saving, and also, from a public health standpoint, means lessened spread of disease.

In the nature of things, this radical departure from usual practices was not looked upon without scepticism. Trustworthiness was doubted and many failed to realize that the aim of the method was not diagnostic precision but detection of something abnormal. Nevertheless, its preeminent practicability, supreme economy and general suitability for mass survey purposes were such as to insure the recognition it has now won. This gain is naturally one of the most important fruits of the past 5 years.

The tuberculosis control program was started under the guidance of the Physical Qualifications and Medical Records Division of the Bureau of Medicine and Surgery, but eventually and logically it has come under the direction of the Preventive Medicine Division where it now constitutes an important section.

Personnel coverage.—As already related, the program started with seven units devoted to survey of recruits at our training stations. Since all recruits are now examined at induction centers, these units have been turned to other uses. The number of units has been increased to forty-three. Two mobile units have been put in service, employed largely on survey of V-12 students. These units have done excellent work.

The aim now is to provide complete coverage of the Navy, not neglecting civil employees. Roentgenographic examination of the chest of all Naval and Marine Corps personnel is required as part of the physical examinations made to determine fitness for entry into the service, for active duty, for separation from the service, and for release to inactive duty. In addition, examination of active-duty personnel under the age of 30 years is made at yearly intervals where practicable. Personnel of any age who have x-ray findings of possible future significance, receive the examination every 6 months, when practicable. A very important step toward this end has already been taken with the establishment of units in Navy Yards, receiving stations, and distribution centers within the continental limits and at Pearl Harbor. In addition, six more

mobile units are being provided to secure the required examinations at stations which have not been assigned stationary apparatus.

During the first 6 months of operation of this campaign, approximately 323,500 photofluorographic films were received in the Bureau of Medicine and Surgery; of these, 550 indicated a strong presumption of active pulmonary tuberculosis and 148 showed other disqualifying defects. In all instances the photofluorographic findings were confirmed by a 14 by 17-inch roentgenogram. The main difficulty is the provision of roentgenologists, chest experts and technicians skilled in this work. However, personnel is being trained as rapidly as possible to meet the needs, and substantial progress is certain even though slower than we would like.

Technical improvements.—(1) The first photofluorographic apparatus used were 250-exposure series cameras of regular photographic type, equipped with F 1.5 lenses. They served well but the number obtainable was very limited and moreover they were not as rugged and foolproof as desirable for the huge volume of work they were called upon to do. At about this time a complete photofluorographic unit was provided in which the camera screen assembly was integrated with the x-ray tube in a single unit. The camera was again equipped with an F 1.5 lens but was of 36-exposure type. These have been standard equipment up to the present. They have performed well but the small rolls are a handicap.

All of this indicated that the Navy itself should do something about the matter and so the development of a camera especially adapted for the work was finally made a research project. This was carried to successful conclusion, and the cameras are now being distributed as fast as circumstances permit. The camera is electrically operated and is automatic. It is integrated with the x-ray control so that at the termination of each exposure the film is advanced; furthermore an audible signal is made as the film is being advanced so that failure of operation will be surely detectable at once. When the film supply is exhausted the x-ray circuit is broken until the camera is reloaded. Fifty-foot rolls of unperforated 35-mm. film are used and make possible close to 400 exposures on each trip.

The lenses from the old type cameras are used and it might be noted here that the lenses are now coated to lessen loss of light by reflection from surfaces and so increase speed. Description of the camera and its operation are to be found in the manual, "Fundamentals of X-ray, Physics, and Technic" (6), distributed by the Naval Medical School. In addition, a special booklet is provided

by the Naval Medical Research Institute containing amplification of the data and detailed information relating to installation.

It was realized some time ago that the usual 35-mm. camera produced only a 23-mm. image and that it should be possible to do better. Thus when the new camera was developed a 32-mm. image was provided for by dispensing with perforations on the film and of course changing optical factors. This is a notable improvement by which the area of the image is almost doubled.

Because it was felt that any eventual necessary repairs would be apt to entail undesirable interruption of work, a simple hand operated camera has been devised which can easily be substituted for the automatic model during the periods when repairs may have to be effected.

X-ray equipment.—Originally 200-milliamperes units of conventional type were used. These still appear best for general use, but under special circumstances of uncertain current supply, and where only 110-volt current is available, use of condenser discharge units is more convenient. They are extremely useful on mobile installation and are being used on them. However, for the best results an increase in their capacity of from $\frac{1}{2}$ to 1 microfarad has been found advisable.

Grids.—Use of stationary grids in front of photofluorographic screens was originally optional but is now routine. This is because studies indicate improved resolution, better contrast, and increased latitude.

Tubes.—Heavy duty types, with air-cooled anodes, were originally called for and the need for such has not changed. "E" focal spots (5-mm.) are best, or rotating anodes.

Timing.—Proper exposure is one of the most important elements in producing good results and is the factor most subject to error. Morgan (7) has devised an automatic timer which has proved excellent and consistent in performance. Adaptation to fluorographic units has been successful and ever increasing use is probable. At the Naval Medical School the special problem of adapting an automatic timer to condenser discharge apparatus is now being studied, and success is anticipated. It should be noted here that consistent accurate exposure is of enormous importance, since variations in radiographic density make interpretation of chest films still more difficult and uncertain.

Processing.—Much work has been done on developers and innumerable formulas tried. The matter of optimum detail and contrast is difficult inasmuch as a maximum of one diminishes the other. In general it can be said that the usual x-ray developers which are of contrast type, answer well and are convenient. How-

ever the finest grain and clearest film is obtainable by use of a formula based on metol with a wetting agent (alkanol B).

Viewers.—The Leitz viewer originally used is still standard. Much effort is being expended in an attempt to obtain better viewers. Many promising beginnings have failed to materialize due to optical difficulties such as troublesome “phantom” images, but it is confidently expected that a much improved viewer will be available in the near future.

Miscellaneous.—It was demonstrated some time ago that 46-mm. film could be used with the present lens equipment, thus producing a larger image with but little alterations in equipment. This appeared tempting but change in size of film was not favored and it was found that practically the same size image would be obtained on 35-mm. film by the means already described. The 70-mm. units which are available on the market, require more material and larger and much more expensive cameras; the image is decidedly larger, but it is still not large enough for direct viewing. It is not as yet certain that the increase in detail will prove sufficient to offset the increased expense.

Future technical improvements.—Improvement is expected in lenses, screens, emulsions, and processing methods. How much further we can go in such matters is for future research to decide.

SUMMARY

The first 5 years have seen both technical improvements and vast expansion in the program being put in effect. It is certain that the Navy is doing a full share in the campaign against tuberculosis with results that will not only prove of benefit to the service and its military effort but will, in addition, play an important part in advancing the health of the whole nation.

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IMMUNIZATION OF RHESUS MONKEYS AGAINST MALARIAL INFECTION

The injection of formalin-killed *Plasmodium knowlesi* parasites combined with a lanolin-like substance and paraffin oil containing killed tubercle bacilli modifies parasitemia and prevents fatal infection with *Plasmodium knowlesi* in rhesus monkeys.—FREUND, J.; THOMSON, K. J.; SOMMER, H. E.; WALTER, A. W.; and SCHENKEIN, E. L.: Immunization of rhesus monkeys against malarial infection (*P. knowlesi*) with killed parasites and adjuvants. *Science* 102: 202-204, August 24, 1945.



LIGHT AND EYESTRAIN

Excessive light may produce symptoms of eyestrain in susceptible persons regardless of source. Constitutional factors should be corrected as well as the amount and kind of light. Twenty foot-candles are essential for such critical tasks as reading. Higher levels of illumination are desirable for prolonged seeing, for discrimination of the details and where low contrast prevails. These standards can be readily maintained in working places through use of properly installed fluorescent lighting.—COUNCIL ON INDUSTRIAL HEALTH: Effect of fluorescent light on vision. *J.A.M.A.* 128: 1229, August 25, 1945.



PENICILLIN IN TREATMENT OF YAWS

Penicillin brought about the rapid and complete healing of the cutaneous lesions of 41 cases of primary and secondary yaws. There was one clinical relapse, which responded well to re-treatment, in a group of patients observed for periods as long as 20 weeks following the institution of therapy. Penicillin was used successfully in the treatment of one case of tertiary yaws which had proved previously refractory to therapy with arsenic and bismuth compounds and with potassium iodide. During the period of observation penicillin did not effect permanent seronegativity in any of the 42 cases of yaws treated. The use of 100,000 units of penicillin administered within 12 hours merits further study because of its potential value in the mass treatment of infectious yaws.—WHITEHILL, R., and AUSTRIAN, R.: Further observation on treatment of yaws with penicillin. *Bull. Johns Hopkins Hosp.* 76: 274-294, June 1945.

DYSENTERY EPIDEMIC

REPORT OF ONE HUNDRED EIGHTY-FOUR CASES

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In late June and early July 1945, a destroyer tender experienced an epidemic of bacillary dysentery caused by the shigella group, Flexner types III and VII.

A total of 184 men, complaining of diarrhea, was admitted to the sick list. Numerous stool cultures were made and no causative organisms found. Their symptoms were mild and recovery prompt. Those men contracting the infection were treated by early isolation, enforced fluids by mouth or parenterally when necessary, sulfadiazine, sodium bicarbonate, and opium mixtures as required. The majority progressed favorably and were comfortable and free from fever and diarrhea in 3 days. No fatalities occurred. One man was transferred to a hospital ship because his symptoms suggested a possible intestinal perforation.

Cultures of water from all of the fresh water tanks were made on 3 July, and although they were negative for the colon-typhoid-dysentery group, the bacteria count was high in each culture. This was considered as a possible cause of the diarrhea, and chlorination of all fresh water, two parts per million, was instituted on 7 July. Use of salt water for washing down decks was also discontinued on the same date. Subsequent examinations showed chlorination to be adequate and cultures satisfactory.

On 12 July three patients in whom fever and diarrhea were much more pronounced than in previous cases were admitted. Stool cultures were made on the three men. Two were negative for enteric pathogens, but one showed *Shigella flexneri* VII.

Realizing the danger of such an infection aboard ship, a drastic program of prophylaxis was organized and put into effect with the assistance and advice of an epidemiology unit. The conclusion that the infection had been brought aboard from the beach was reached.

The following measures were taken:

1. The fresh water was chlorinated, using 2 parts per million.

2. Use of salt water for any cleaning purpose was discontinued.

3. Sulfadiazine prophylaxis, 1 gm. per day, was given all hands.

4. Antiseptic solutions were placed in all heads, with sentries to enforce use.

5. Antiseptic solutions were placed at the gangway, with sentries to enforce use by all hands coming aboard.

6. Sale of all food at ship's store was stopped and the soda fountain closed.

7. All private coffee messes were discontinued, and the mess gear was called in.

8. Traffic to and from other ships was reduced to a minimum.

9. A man was placed in each chow line to hand out silver to prevent others putting their hands in the silverware trays.

10. All self-service was prohibited.

11. Eating of food anywhere except in mess halls was prohibited.

12. The taking of any food ashore to be eaten, or obtaining food ashore to be eaten there or to be brought aboard was prohibited.

13. The purchase of food from bum-boats was prohibited.

14. All food handlers were examined by the medical department.

15. All messmen serving in the chow line were examined before each meal, enforcing washing of hands in antiseptic solution and soap and water immediately before serving each meal.

16. Three officers were on duty in mess halls at each meal; one deck officer to supervise operation of the scullery; one commissary officer to supervise serving; and one medical officer to remove men with dirty hands from the chow line and watch for other violations of sanitary precautions.

17. A vigorous campaign was prosecuted against the few flies found aboard.

18. An educational program on cleanliness was conducted, at quarters and via the movies, giving demonstrations on the necessity of clean habits in combating this particular disease.

19. A movie on personal hygiene was shown.

20. Crew members were encouraged to report to sickbay immediately if any illness or digestive disturbance developed.

21. All cases were promptly isolated.

22. Sickbay linen and eating utensils were treated with antiseptic solution before returning them to laundry or scullery.

23. Stool cultures were made on 98 food handlers, 2 of which were positive in men who denied symptoms.
24. The use of common drinking jugs or cups was prohibited.
25. Swimming was prohibited.
26. Organized recreation was discontinued.

NOTES ON OUR RESERVE CONTRIBUTORS

Alston, William F., Ensign H(S) USNR (*Studies on Louse-borne Relapsing Fever in Tunisia*, p. 1029). B.A., Maryville College (Tenn.) 1939; M.S., State College of Agriculture and Engineering of the University of North Carolina, 1941. Teaching fellow in botany, State College of Agriculture and Engineering of the University of North Carolina, 1939-41; instructor in biology, Chester High School, Chester, Pa., 1941-.

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